

PROGRESSIVE MEDICINE





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1917

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PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE
MEDICAL AND SURGICAL SCIENCES

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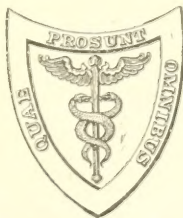
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VOLUME IV. DECEMBER, 1917

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS,
AND PERITONEUM—DISEASES OF THE KIDNEYS—GENITO-URINARY DISEASES
—SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS,
FRACTURES AND DISLOCATIONS, AND TUMORS—PRACTICAL
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PROGRESSIVE MEDICINE.

DECEMBER, 1917.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS, AND PERITONEUM.

By MARTIN E. REHFUSS, M.D.

IN reviewing the progress which has been made in gastro-intestinal diseases, it has become increasingly evident that the war has markedly inhibited research along these lines or absolutely prevented the transmission of journals from the countries at war. The German and French journals, with the exception of such organs as the *Presse Médicale* and a few other representative journals of large circulation, have been almost completely cut off, while the journals which particularly interest us, such as the French *Archives des Maladies de l'Appareil Digestif*, and the German *Archiv der Verdauungskrankheiten* have been almost entirely shut off. It is probable that in those countries scientific work has become almost entirely arrested and the one conclusion seems to be that America must become the scientific leader after the war. Even in England, where the *Lancet* and the *British Medical Journal*, and others of that category, have been published regularly, the scarcity of articles pertaining to this field reflects the general lassitude which would naturally appear. Instead, the pages are filled with war surgery and matters pertaining to military affairs. The intestinal infections come in for unusual attention, and the various parasitic and bacterial diarrheas and dysenteries are unusually prominent. Again a striking condition since war times has been the frequency of a form of infective jaundice often fatal and of spirochetel origin, known as *icterohemorrhagic spirochetosis*. This condition merits attention and will be discussed here. In references to Swedish, Danish, Norwegian, Spanish, or Russian articles, the excellent abstracts from the *Journal of the American Medical Association* and those of *Surgery, Gynecology and Obstetrics* have been used.

To America we must look for the future progress in this field. In the past year the bulk of the literature pertaining to gastro-intestinal problems emanated from this country, and with it comes the promise of excellent work all along the line. This impetus may be expected not

merely along strictly clinical lines, but also much good can be expected from the practical application of important discoveries emanating from purely physicochemical research concerning which there is at present a very marked increase. Unfortunately, at the present time, the United States has joined the world war and many men whose labors were exclusively devoted to this field have devoted all their energies to the problem of war. Dr. Edward Goodman, who contributed the former reviews on the progress of gastro-intestinal medicine, is away at the front, and it is not unlikely that before many months many of us will be engaged in a similar duty. It is to be hoped, however, that the dawn of peace is not far distant and with it will evolve an era during which unprecedented progress will be made. The tremendous problems of carcinoma, the natural history and causation of ulcer, the intricate pancreatic and duodenal mechanism, the mechanism and control of gastro-intestinal infections, and the comprehension and control of intestinal intoxications are but a few of the problems which await solution.

Hyperalgesia in Abdominal Disease. Ligat¹ contributes an interesting study on the diagnostic value of maximal points of hyperalgesia of the skin and subcutaneous tissue of the abdominal wall in affections of the abdominal viscera. In the consideration of this subject it must be remembered that three theories have been put forth regarding visceral pain.

1. Mackenzie suggested, in 1891, that no viscus could appreciate pain as such, but that all so-called visceral pain was really pain referred to, and felt in, some area of the body wall.

2. Head and his co-workers, Rivers and Sherren, consider that a viscus is possessed of protopathic sensation.

3. Hertz is of the opinion that the viscus does feel pain as such, and that the only true cause of visceral pain is increased tension.

Ligat believes that all the pain the patient complains of, and the tenderness that an observer can elicit, would seem to be due to a true viscerosensory reflex, and not in any way to pain or tenderness in the organ itself.

Afferent impulses from all the viscera are constantly passing to the spinal cord, whence reflex efferent messages are constantly transmitted to the tissues of the body wall. But when an organ, or a part of an organ, becomes irritated or inflamed, more urgent impulses than normal ascend to the group of cells in the spinal cord, which is in direct nerve control with the affected organ, and this group of cells, being subjected to undue stimulation, forms an irritable focus in the spinal cord.

We then get an abnormal stimulus in the corresponding cutaneous surface of the body wall. In other words, a pinch, which, in a person with a spinal cord of normal tone, would not have given rise to pain, now does so, on account of the stimulus due to the pinch being received by a part of the cord which is being kept in an irritable condition by undue stimuli from a diseased focus.

In testing the skin, Ligat grasps the skin and subcutaneous tissue between the finger and the thumb, and draws them away from the deeper layers of the abdominal wall. If a hyperalgesic area is present, the patient winces, and one can tell by the patient's expression that such an area is being stimulated. He found that frequently it was not confined strictly to any segmental area. Furthermore, he found points about the size of a quarter which were decidedly more sensitive, probably corresponding to the subcutaneous distribution of certain branches of particular nerves. The two sides are compared as much as possible and the technic standardized. For instance, the maximal appendix point is situated at the junction of the upper and middle thirds of a line drawn from the umbilicus to the right anterosuperior spine, at which point certain twigs of the eleventh dorsal nerve have become subcutaneous and can be picked up in the fingers and included in the tissue pinched. This is McBurney's point, which has long been known as tender on pressure in acute appendicitis. In examining the abdomen, one therefore picks up and pinches precisely the corresponding point on the left side, at the same time asking the patient to appreciate the sensation produced. This is immediately followed by pinching the same point on the suspected side. We now determine which is the most hyperalgesic point in this area; if it is that point, a definite diagnosis of appendicitis can be made. In this area in the female, there is one more definite point corresponding to a particular organ, namely, the right Fallopian tube. This point is situated at the junction of the lowest and adjacent fourths of a line drawn from the middle of Poupart's ligament to the umbilicus, at which point some twigs of the twelfth dorsal nerve become subcutaneous.

In many cases of acute appendicitis, hyperalgesia is elicited at this point also, but it is never so pronounced as it is over the appendiceal point. In severe renal or biliary colic, or perforating ulcer, pain may be so great, and hyperalgesia so widespread, that few of its characteristics can be made out. But when one organ is affected, the following points should be noted: (1) One maximum point, (2) hyperalgesia usually spreading more in a downward than an upward direction from this point, (3) little, if any, lateral spread in either direction.

In the gall-bladder, for instance, the maximum point is situated where a horizontal line drawn from the tip of the tenth rib crosses a vertical line midway between the nipple line and the midline of the abdomen. Out of 54 cases of cholecystitis, in many of which gall-stones were present, and all of which were operated on and verified, 41 gave marked hyperalgesia at that point. In 243 consecutive cases of appendicitis, 195 gave definite hyperalgesia at its maximal point, which has already been noted and which falls vertically below the gall-bladder point. Out of 39 cases of tubal disease, 20 gave a positive response over the point already described. In 80 cases of gastric and duodenal ulcer, 50 gave a positive response at the maximum point which in all these cases was situated exactly in the midline, midway between the ensiform and the umbilicus.

He says that in grouping stomach, large and small intestinal disturb-

ances together and separating them as a group from gall-bladder, appendiceal, and Fallopian tube conditions, the mechanism of the arc is similar, and the reflex is produced and obtained in the same way, but in details they differ:

1. The hyperalgesia produced is found somewhere in the middle line of the body wall, somewhere between the ensiform cartilage and the symphysis pubis.

2. The hyperalgesia usually produced is not so acute as that produced in the ordinary cases of cholecystitis, appendicitis, and salpingitis, but is definitely more persistent. Concerning the gastric and duodenal ulcer, the point has almost always been in the same position with more of a downward tendency toward the umbilicus than upward toward the ensiform. He has not been able to differentiate the position of the ulcer. This point probably corresponds to the subcutaneous distribution of the ninth dorsal nerve. The gall-bladder and gastric points may both be present and can be elicited in combined lesions.

In a series of 11 cases of perforated ulcer, 4 gave an intense reaction, 7 gave a negative response, although great rigidity and tenderness on pressure was evident. He explains this by nerve destruction.

There is a maximal point in small intestinal lesions, one of which occurs with chronic appendicitis, the other a case of acute inflammation of Meckel's diverticulum. In the small bowel, the point is central in position.

Difficulties can be encountered in general peritonitis, or local peritonitis with edematous infiltration of the abdominal wall, and, finally, in neurotic individuals suffering from some intra-abdominal lesion. His conclusions are as follows:

1. For diagnostic purposes all visceral pain may be regarded as due to a true viscerosensory reflex.

2. Spread does not take place uniformly from segment to segment, but hypertonicity, which has been set up in a certain group of spinal cells, is communicated to an adjacent group of cells which subserve the same physiological function in the spinal cord, and the lower group of cells is more strongly stimulated. That impulses do not readily pass from cell groups in the spinal cord, which correspond to the lateral organs (gall-bladder, appendix, and tube) to the spinal cells, which correspond to the central organs (stomach, duodenum, and gut).

3. Hyperalgesia elicited by pinching is of definite diagnostic value, but in a certain number of cases it is negative, so that it should only form part of the clinical examination.

4. The positive response indicates, in the majority of cases, the organ primarily diseased.

5. The explanation of a negative response and of very serious cases is a block in the afferent response.

6. Slow distention of a viscus does not give rise to either pain or hyperalgesia.

7. Rapid distention may give rise to pain, but that pain cannot be localized by the patient to the offending organ.

8. Probable factors giving rise to hyperalgesia:

- (a) Mechanical irritation of the nerve endings in mucous and sub-mucous coats.
- (b) Diapedesis in causing mechanical pressure on nerve endings.
- (c) Chemical toxins produced by organisms.
- (d) Doubtful, irregular and excessive contraction of gut muscle *per se*.

DISEASES OF THE TONGUE AND MOUTH.

Clinicians have maintained for a long time that the tongue was an index to conditions of the gastro-intestinal tract. There can be no question that various gastro-intestinal conditions do markedly affect the condition of the tongue and even the whole oropharynx, but, recently, more careful study has emphasized the fact that many coated tongues, and particularly those associated with only partial coating of the tongue, are to be explained by conditions in the oropharynx rather than in remote portions of the gastro-intestinal tract. Postnasal catarrh, chronic tonsillitis, pharyngitis, and pyorrhea are particular offenders of this type and should always be considered.

Faber¹ renews the discussion as to the

Value of the Tongue as an Index of Intra-gastric Conditions, and points out the fact that the mucous membrane lining the tongue shares many of the conditions in common with the gastric mucous membrane. For instance, it takes part in the general gastro-intestinal atrophy accompanying pernicious anemia, and is supposed to be an early symptom of cancer, tuberculosis, and other cachectic conditions affecting the gastric mucosa. In short, he claims that atrophy of the mucosa of the tongue is nearly always a sign of atrophy of the gastric mucosa. In 106 patients with stomach trouble, the epithelial layer of the tongue had few, or no, papilla, was smooth, shiny and never coated in all cases where atrophy of the gastric mucosa was evident. In another group of 130 patients suffering from internal or constitutional disturbances, the tongue showed no atrophy except in 5 cases of pernicious anemia, one of cancer of the abdomen (?), and one of granulomatosis. In one case of gastric achylia without atrophy of the tongue, the later finding he took to mean a nervous element in the mechanism of achylia. In conclusion, he states that when we find marked atrophy of the tongue, we can dispense with the test meal, unless further research upsets such deductions. These findings are shared by many men, and the clinician is not infrequent who points to the smooth, glossy, salmon-colored tongue as a sign of gastric carcinoma.

The question of

Tuberculosis of the Tongue is one which is discussed by Scott.² He claims that tuberculosis of the tongue is more common than ordinarily suspected and is commoner among males who are prone to carry "miscellaneous objects," by which I suppose he means tobacco or pipes, in their mouths. While it is common at all ages of life, it is most common at the cancer age, between forty and fifty. It occurs

¹ Ugesk. f. Læger, Copenhagen, March 15, vol. lxxix, No. 11, p. 409.

² American Journal of Medical Sciences, 1916, vol. clii, p. 411.

in two forms, primary and secondary, the latter being more numerous. Clinically, it assumes different types, such as ulcerated fissures, a granulomatous and a papillomatous type. The differential diagnosis involves the consideration of simple ulcer, local manifestations of lues, carcinoma and epithelioma. Complete excision, he claims, is the rational treatment.

Infections of the mouth including the tongue are not infrequent, and an interesting contribution of Campbell and Dyas¹ on the presence of

Epidemic Ulceromembranous Stomatitis or **Vincent's Angina** affecting the troops in France is worthy of notice. These authors report 129 cases occurring from October, 1916, to February, 1917, in their service. They mention particularly the frequency of this condition among the troops in France, where it is known as "trench mouth." Four types are described: (1) Tonsillitis, (2) a deep ulcer on the ramus of the lower jaw immediately behind the last molar, (3) associated with pyorrhea and mercurial stomatitis following the treatment for syphilis, (4) general mouth infection. Seven cases of general bronchial infection and 4 of balanitis also came to their attention.

Interesting is the fact that in 50 per cent. of all swabs taken from the throats of soldiers, a few Vincent organisms were found. The differential diagnosis from diphtheria is made by bacteriological examinations, both are tough mucous membranes, removal of which leaves a bleeding surface. Arsenic is of the most value in treatment, and for mouth ulceration the routine treatment is liquor potassii arsenitis swabbed on the lesions three or four times a day. When deep ulceration occurs, the ulcer is first swabbed out with 10 per cent. silver nitrate solution and the treatment continued with arsenic. In pyorrhea they used the mixture recommended by Bowman² which is as follows:

Vinum ipecacuanhae	1/2	ounce
Glycerinum	1	dram
Liq. arsenicatis	q. s.	1 ounce

A few drops on a tooth-brush and brush well.

Perleche, an infection of the labial commissures, may be considered as properly belonging to the domain of gastro-enterology although it is essentially a disease of childhood. Smith³ describes the disease as it occurred in 223 cases. It manifests itself by means of maceration of the epithelium and desquamation of this tissue, and by the formation of shallow ulcers or cracks. The anærobic streptococcus was found in pure culture in 165 cases, twenty-six times the same organism was found in combination with the *Streptococcus pyogenes aureus*, seven times with the *Streptococcus albus* and fourteen times in association with the *Streptococcus pyogenes*. In the later stage, the anærobic streptococcus is not found at all, but apparently disappears after secondary infection.

The mouth condition should be corrected, the lesion painted with 50 per cent. silver nitrate and Lassar's paste applied. Tincture of

¹ Journal of the American Medical Association, vol. lxxviii, No. 22, p. 1595.

² Proceedings of the Royal Society of Medicine, 1915, p. 9.

³ Archives of Pediatrics, New York, April, vol. xxxiv, No. 4.

belladonna is used internally, and spirit of camphor or alcohol applied externally. In pus infection, 1 to 1000 bichloride of mercury is recommended, the crusts removed and followed by an application of 5 per cent. ammoniated mercury ointment.

Before leaving the subject of mouth diseases, it might be well to discuss for a minute the question of treatment

Other than Surgical Treatment of Malignant Mouth Conditions. There are four different methods of treatment of malignant diseases of the mouth: Surgical removal, local destruction by means of electrothermic coagulation, deep röntgenotherapy, and the application of radium to the mouth.

Pfahler¹ believes that electrothermic destruction gives better results than excision in the mouth. He urges, however, excision of the palpable metastatic glands in the neck. Following the treatment, deep röntgenotherapy should be used. Electrothermic coagulation is offered by the resistance of tissues to the flow of electricity and can be gauged to a nicety as to the extent of its application. With sarcoma, however, it is of doubtful utility, and here the author recommends röntgenotherapy alone. The advantages of this type of treatment are:

1. The disease is destroyed by conductive heat which gives a zone of devitalization without the actual destruction of healthy tissue.

2. There are no raw surfaces to permit transplantation.

3. No blood or lymphatic vessels are opened.

4. Hemorrhages are not feared.

5. There is no local infection.

The object of deep röntgenotherapy is to destroy the outlying cells which may be missed in the coagulation process. The author believes that radium should be used only in the mouth and not outside. A resumé of his results is given which indicates that the method is of particular value in cancer of the lip. In 6 cases involving the dorsum of the tongue, 1 died and 4 recovered and have remained well from one to four years. One case was too recent to classify. In epithelioma involving the cheek bone, cheek gums, jaw bone, and submaxillary glands, he was disappointed in his results.

Chronic Mouth Infection. Moorehead² discusses the question of mouth infections which from a gastro-enterological stand-point are of extreme importance. *Chronic alveolar abscess* may be classed as primary or secondary: Primary, those in which infection occurs through the root canal from an infected pulp; from faulty technic in root canal treatment; from a failure to adequately seal the root canal and pulp chambers in the introduction of permanent filling materials. Those infections classed as secondary are blood borne, the predisposing cause being a lowered resistance in the periapical tissue brought about, (1) by the careless use of arsenic as a devitalizing agent, and (2) by the indiscriminate use of irritating agents in the treatment of root canals. The irritation set up in the tissues at the apex of the root results in a stimulation and multiplication of the fixed tissue cells, and the end-result is scar

¹ Journal of the American Medical Association, 1916, vol. lxvii, p. 1502.

² Ibid., p. 845.

tissue, which interferes with the normal circulation. The resistance of such areas is relatively low. A periapical infection in a vital tooth can scarcely occur. These secondary infections may be largely represented by the principle of asepsis rather than antiseptics. More good and less harm is accomplished by surgical cleanliness than by the use of antiseptics and disinfectants.

His conclusions are as follows:

1. The incidence of chronic mouth lesions in a group of over 700 carefully analyzed cases, showing percentages ranging from 69 to 89 per cent., must be looked on as more or less serious evidence.

2. The overwhelming majority of chronic abscesses being associated with previously treated root canals serves to emphasize the importance of root-canal technic.

3. Both in diagnosis and in determining the extent of tissues lost, the röntgen rays are paramount.

4. The involvement of the peridental membrane is the crux in deciding between conservative and radical treatment.

5. Faulty root-canal technic, the careless use of arsenic as a devitalizing agent, and irritating drugs in the treatment of root canals are strong predisposing factors of chronic alveolar abscess.

6. In carefully selected cases conservative measures should be employed, both in the treatment of chronic abscess and chronic pericementitis.

7. When root canals have been disinfected and filled, portions of roots resected, etc., the process of repair should be checked up by röntgenograms made at frequent intervals.

8. Regardless of whatever form of treatment may be employed, the removal of infection is imperative in all cases, whether the patient at the time may be well or ill.

Where the health, comfort and usefulness of a patient are to be weighed over against a tooth, or even all the teeth, the greater interests of the patient must be preserved.

Sublingual Medication. Paulson¹ discusses the question of the application of drugs by sublingual medication. He calls attention to the thin membrane, considerable area, and large veins of the sublingual space, and says that for the absorption of concentrated medication, the sublingual space is the most reliable surface in the whole body. The only preparation is rinsing out the mouth with water. A morphine and atropine disk, powdered with a knife-blade, on paper creased in the center and the powder dropped just behind the teeth will insure the absorption of that powder in a few seconds. An apomorphine disk applied in the same way will induce vomiting at once. Compared with hypodermic injection, the sublingual method is quicker, safer, easier, and more reliable.

For the relief of severe pains, such as those of renal and biliary colic, the method will be found of incalculable service. Murtz,² endorses the views of Paulson and mentions cases in which its value was definitely demonstrated.

¹ Practitioner, 1916, vol. xcvi, p. 389.

² Ibid., p. 582.

DISEASES OF THE ESOPHAGUS.

Esophagus Cancer. Lerche¹ discusses the etiology of cancer of the esophagus and the stomach. He collected 4020 cases of carcinoma of the esophagus and works out the contention that "chronic irritation from the ingestion of hot fluids is an important predisposing cause of cancer of the stomach and the esophagus."

His conclusions are as follows: 1. Cancer of the stomach and, in particular, the esophagus is prevalent among the inhabitants of the temperate zone.

2. The relative frequency with which cicatricial strictures from swallowed corrosive liquids occur in various parts of the esophagus increases from above downward. In other words, the widest parts of the esophagus are the most frequent sites of such strictures.

3. The distribution of cancer of the esophagus corresponds to that of cicatricial stricture from swallowed corrosive liquids, and in all probability for the same physiological reasons.

4. Any part of the stomach or esophagus may be the starting-point of cancer with the exception of the pyloric sphincter which rarely seems to be the primary focus. The duodenum is practically immune from cancer. The reason for the two latter phenomena is probably the fact that the ingesta do not reach the pyloric sphincter until they are properly modified.

5. In view of the foregoing conclusions, it seems logical to look to the ingesta of civilized man for the source of chronic irritation, which leads to malignant changes in the esophagus.

6. The supposition that swallowed liquids, after emanating from the cardia, are directed along the "gastric gullet" to the prepyloric region, is strongly supported by the fact that cicatrices from smaller quantities of swallowed corrosive fluids are usually found along this path.

7. Seventy-nine per cent. of cancers of the stomach are found along this pathway, namely, the cardia, "the gastric gullet," and the prepyloric region.

8. As cancer of the stomach follows the "highway" of fluids, it seems logical to assume that the ingested liquids in particular may be responsible.

9. Alcohol, and other irritating fluids, probably play a part, but, in the opinion of the author, hot fluids so universally taken play the predominating role.

10. Cancer of the esophagus occurs less frequently in women than in men, because women drink more slowly and take smaller swallows which pass quickly through, thus saving the esophagus, while the less resistant mucosa of the stomach, where the fluids come to a stop, is more equally exposed in both sexes.

11. The fact, therefore, that the ratio of cancer in men and women is 3.5 to 1, while cancer of the stomach occurs with almost equal frequency in both sexes points to hot fluids as the most important predis-

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 42.

posing cause. This is further substantiated by a comparison between cancer statistics and the habits of people in the north and south of Europe and by the relative freedom from cancer of the esophagus and stomach enjoyed by the aborigines of the hot climates and the extremely rare occurrence of cancer of the esophagus in animals.

An interesting point in Lerche's statistics is the relative frequency of cancer in different parts of the esophagus. In the 4020 cases collected, 1007, or 25 per cent., were in the upper third; 1316, or 32.7 per cent., were in the middle third; and 1699, or 42.1 per cent., were in the lower third. This is contrary to the accepted opinion that, in the majority of cases, cancer of the esophagus affects the lower third.

DISEASES OF THE STOMACH.

In the study of gastric disease, it has become apparent that these conditions are being submitted to more careful study. Not only have the methods of röntgenological examination been refined, but intragastric methods have been improved and the fractional examination of gastric digestion, such as I have described, has found much more extended application. Apart from refined chemical methods, the use of the kymograph and the intragastric balloon, following the steps of Carlson and his co-workers, has been used by a few workers in their clinical researches. It is to be hoped that progress along these lines will be made as soon as possible and the important point, the significance and the method of interpretation of the findings will be solved. We are gradually accumulating methods of precision which have done more than anything else to lift gastro-enterology from the empiricism which has clothed it to the dignity of a science, even though as yet that science is imperfect. Nothing contributes more to this movement than the evolution of satisfactory instruments for carrying on this work. Serial radiography, newer methods of fluoroscopy, and the improvement of x-ray apparatus have opened up this field to a marked degree. The author remembers the statement of Haudek back in 1912, and it seems as if that astute observer had already been able to see the future of this science. Haudek said that the fundamental principles were all laid down and that from that time the only real progress in gastric röntgenological work would be refinement of detail. Succeeding years have served to confirm that view-point, and it seems as if this science had outstripped its clinical associate. Certainly the value of this method is now firmly established, and in certain fields is indispensable.

Fractional Analysis has come to stay. It is now recognized that it is impossible to obtain any adequate knowledge of intragastric chemistry without making a complete study of the entire gastric cycle. Best, Talbot, Crohn, Carroll, Pollock, and others, have written on this method and have confirmed the usefulness of this procedure in clinical work. The method is now entirely practical, and, with the assistance of some capable nurse, it is possible to avoid the time or personal contact so essential to the successful conclusion of the study. The objection that it requires too much time can only be answered by the fact that we

cannot hasten gastric digestion, and when a patient asks me how long the fractional tube must remain in place, I simply say until the stomach is empty, or some equally non-committal phrase, as "while digestion is going on in the stomach, in some cases this is very short, in others long — only such an examination as this will settle the point." The trouble is usually not with the patient, as most patients have no trouble with the tube, but with the physician's time, and here, again, I would insist on the fact that anyone can readily be familiarized with the management of the tube. Not only is it possible to make a careful study of the stomach with the requisite leisure, but it is possible to work out the reaction of the patient to various medicaments and to study the effect of the direct application of substances to the gastric mucous membrane. By this means it is possible, with a minimum of discomfort, to apply directly to the mucous membrane substances in greater concentration than can be given by mouth, and then, after a definite time interval, reaspirate the material which might otherwise seriously affect the stomach or bowel.

Fractional analysis should always be preceded by an examination of the empty stomach. This is readily done with the fractional tube and the presence of an increased residuum, the presence of pathological hypersecretion, of food retention, the presence of blood or pus, both swallowed or even from intragastric lesions, should be investigated. Lavage and cytodiagnosis can then be carried out, if desired.

After this the routine method is usually the administration of the Ewald meal which, for all ordinary purposes, is still the most satisfactory meal for general examination. As Best points out, "the Ewald meal is perfectly satisfactory in every way save in the possibility of the particles blocking the tube and in its low protein content." If the meal is well masticated, the blocking is rarely produced, and if aspiration is performed slowly, the two difficulties of fractional testing, blocking of the tube or traumatic bleeding, are almost entirely overcome. This very gentle aspiration is the most difficult point for the beginner to learn. He usually grasps the distal end of the syringe and begins to suck the material into the syringe with all power possible and then wonders why the material gives a positive occult blood reaction. There are three reasons why material can no longer be aspirated: (1) It is not in proper position, *i. e.*, either insufficient tubing has been inserted, and it must be remembered that the distance of the stomach from the incisor teeth varies in different individuals, or cardiospasm may block the entrance of the tip into the stomach for a short time, (2) the tube may be blocked by food particles, in which case injection of water or even the withdrawal of the tube and its reinsertion are necessary, (3) the stomach is empty, which is readily confirmed by lavage. The low protein-content of the Ewald meal is really an advantage rather than a disadvantage, inasmuch as pathological protein is readily recognizable in this way. It must be remembered that this form of testing is often as important, if not more important, than that of the acid in many cases. Clark and I pointed out that protein in excess of the normal amount found in the secretion must always be explained either by an intragastric lesion or the swallow-

ing of pathological protein, usually pus or blood. In this way, apart from the water meal, the Ewald meal most readily lends itself to examination. Furthermore, the presence of food retention from previous meals, particularly fat and meat, as well as bacteria, are readily recognized. All in all, the Ewald meal, owing to its short digestive time, its simplicity, and its readiness of preparation and the ease with which it can be measured or standardized, ought to be retained. The meats generally give a higher acid, require a longer time for digestion and are generally not applicable, nor do they offer any real advantage for study. The meal of "Liebig's beef extract," suggested by Skaller, may be used and never clogs the tube, but, in my opinion, the response is not as characteristic as that of the Ewald meal and the curve from our studies varies comparatively little from that of a straight water meal. The water meal, as suggested by Austin, has much to recommend it owing to the fact that water, as Hawk, Bergeim and myself have shown, is an actual gastric stimulant and not comparatively inert as Pavlov attempted to show in animals. However, it is true that in some individuals water will not stimulate the stomach to the same degree as an Ewald meal, while in others it produces maximum stimulation. The Ewald meal is therefore desirable unless it is desired to show up pathological retention, or pathological exfoliated products from the gastric wall, cells, pus, blood, etc. In determining motility, the addition of coloring matters of every description have been proposed. Boas and Kemmerling some time ago proposed the use of chlorophyll, and Skaller proposed the addition of phenolphthalein to the meal, testing the samples for that substance by means of strong alkali; we used both carmine and indigo, but the objection to these substances is that much of the dyestuff is absorbed by the mucus and foodstuffs and will often disappear before all food has left the stomach, or, again, by adsorption on the part of the gastric wall, the continued secretion, even after all material has left the stomach, will give a reaction. The addition of soluble chemical substances, like urea, seem more justifiable for this procedure.

Fractional analysis reveals many interesting points regarding digestion. Some of these are clear, but many are still mysteries which must be explained by further study. The individuality and the character of the response is apparent to anyone who has made many studies in this field. The normal variations must first be considered before the pathological curves are interpreted. We have pointed out the normal variations and the frequency of a form of continued normal secretion liable to be taken for pathological hypersecretion. The variations in normal evacuation time are also apparent. Many points, however, remain to be investigated. The question of the significance of bile, its presence in over one-half the cases in the normal residuum; the automatic regulation of gastric acidity by the regurgitation of the pancreatic secretion which is now an established fact, but the pathological deviations of which are not clear; the significance of anomalies of the latter in producing hyperacidity or hypersecretion, and even pronounced symptoms and lesions; the mechanism of and the production of increased acid grades and increased secretory output; the estimation of secretory velocity and the estimation of the nitrogen-content by more careful

methods, as well as the affect of infections and disturbed conditions of the circulating blood, all remain to be explained. In almost all these lines work is in progress and it is hoped that results will be forthcoming.

Morse¹ made an interesting study on the

Relation of the Formation of Acid to Gastric Discharge or Evacuation, as well as a few studies on **Duodenal Regurgitation** which are worthy of mention. He used a dog which was anesthetized, and fluid was injected through a glass tube inserted into an esophageal fistula. He found that water was discharged from the fasting stomach more rapidly than any acid material, but that the rate of discharge decreased with an increase in acidity. Duodenal regurgitation, as shown by an increase in the gastric contents (?), often occurred at 0.2 per cent. acidity and in nearly all cases it occurred at, or before the 0.3 per cent. acidity was reached. He reached the conclusion that increase in acidity increases the frequency and amount of regurgitation from the duodenum.

Swanson² showed that extirpation of the salivary glands in the dog does not decrease the gastric juice secretion (appetite and secretagogue juice) but that the extirpation of these glands causes a distinct rise in the acidity of the gastric juice.

Intragastric Temperature. Stengel and Hopkins³ made some very interesting studies on this subject in man by means of an ingenious electrical method consisting of a thermocouple to which afferent wires of different potential were soldered together and placed in an Einhorn tube, the other set being placed in a thermos bottle containing water at a fixed temperature. The other elements were a mirror galvanometer and a potentiometer; the readings being taken in microvolts.

Locating the position of the tip by means of the fluoroscope, they demonstrated definitely the difference in the fundic and pyloric temperatures after the introduction of cold drinks. Apparently, the ingestion of cold substances produces slight variations in pyloric temperature, but a pronounced drop in fundic temperature. Ice-water produced a drop below 32° C. and required forty minutes to return to 36°, while ice-cream produced a drop below 26° C. which took forty-five minutes to return to 36°. Ice-bags applied to the gastric region produced an average drop of 0.9° to 1° C. in the course of forty-five minutes, while the effect of hot-water bags was almost negligible in three-quarters of an hour.

Diagnosis of Gastric Affections without a Stomach-tube. Landerer⁴ discusses, in a rather general way, the diagnosis of gastric affections principally by means of the vomitus and the examination of the feces. The vomitus, while in many ways unreliable, is capable of giving some information regarding gastric function. If the reaction is neutral or alkaline, it may be due to the admixture of saliva; but, if it is acid, the acid must have come from the stomach. If it is excessive in amount, there is hyperacidity beyond a question. Starch digestion in the saliva is of little use, because the action of the saliva cannot be

¹ American Journal of Physiology, 1916, vol. xli, p. 439.

² Ibid., May, 1917, vol. xliii, No. 2.

³ American Journal of Medical Sciences, 1917, vol. cliii, p. 101.

⁴ Med. Klin., October 15, vol. xii, No. 42, p. 1098.

ruled out. Admixture of blood is also unreliable owing to the frequency of blood when vomiting is severe. If rennin or pepsin are found, these are conclusive, but their absence does not necessarily indicate an absence of these substances.

All the findings in the vomitus, therefore, are only presumptive, while the examination of the gastric contents is conclusive. In those cases in which the tube cannot be passed, therefore, we must often depend on an examination of the feces after a test diet, and here Landerer offers a few points. As the stomach becomes upset at least ten times more frequently than the pancreas, the finding of muscle fibers and fat in the movement is usually significant of a gastric disturbance. Occult blood should be always sought if there is the least suspicion of ulcer or cancer. No ulcer case should be discharged until several stool examinations reveal a negative occult blood reaction.

A patient with a good appetite and apparently good digestion, but with diarrhea, calls for hydrochloric acid. This acts by regulating the pyloric reflex, closing the pylorus and preventing the premature evacuation of food from the stomach. Pain in the stomach, which subsides when food is eaten, is indicative of hyperacidity, but the inference is more likely correct if the pain can be checked by alkali.

Alvarez¹ discusses the question of irritability of different portions of the stomach wall.

"It has been shown that in the frog's stomach the cardia is the most irritable region; also that the latent period is shortest at the cardia and longest at the pylorus. The mammalian stomach has been studied from the point of view that it has developed from a primitive tube, like the heart, and has been enlarged and specialized. The latent period for faradic, galvanic and mechanical stimuli is shortest around the cardia and along the lesser curvature as far as the incisura angularis. These limits include also the most irritable part of the stomach. The region of the greater curvature and fundus is much less irritable and often fails to react at all. The pyloric ring is more irritable and reacts more promptly than does the rest of the antrum.

The duodenum is much more irritable than the pyloric antrum. The posterior surface of the stomach is a little less irritable than the anterior surface, and the latent periods are longer.

With the exception of the cardia and lesser curvature, the stomach *in situ* is often quite refractory to stimulation in its cardiac half. This seems to be due to nervous inhibition, as it is less marked in the excised stomach and still less so in the strips of muscle cut from the fundus or greater curvature.

It seems that the nervous mechanism serves more to restrain the muscle than to render it more irritable.

Effect of Alcohol on the Stomach. Wright² studied the *effect of alcohol on the rate of discharge of the stomach*. He used cats and gave them bismuth-potato mixture, 25 grams of mashed potatoes and 5 grams of a bismuth, and used three series: One with the simple mixture, a second

¹ American Journal of Physiology, 1916, vol. xli, p. 312.

² Boston Medical and Surgical Journal, November 2, 1916.

series to which he added 6 c.c. of 37 per cent. alcohol, and a third series to whom he gave 5 c.c. of 95 per cent. alcohol. The weaker alcohol produced a distinct acceleration in gastric evacuation and the peristaltic waves were deeper than normal. With the stronger alcohol there was a delay, with a slower initial discharge, and a gradual rise in peristaltic waves to a maximum in the third and fourth hour. Secretion was stimulated in the first instance while in the series which received the stronger alcohol the animals were distinctly intoxicated. The *x*-rays were used in the study.

Gastric Pain, its Time in Relation to Gastric Adhesions. Friedman¹ discusses a number of cases in which the time relationship of pain proved of diagnostic help. He divides all pain of the intragastric and perigastric regions into continuous and intermittent varieties. The continuous types are most frequently due to carcinoma, marked pyloric obstruction, penetrating ulcers with peritoneal involvement. The intermittent are divided into immediate, early and late. The immediate are most frequently seen in ptosis, neurosis, obstruction of the cardia, and other conditions, while the early pains, including those in the first hour after eating, are most often due to adhesions in any part of the stomach, including ventral hernias and pericholecystitis.

Late pains, including those found from one to three hours after eating, indicate an increase in intragastric pressure or pylorospasm, of which the most frequent cause, according to this author, is hyperacidity.

Hunger Pain. Hamburger, Ginsberg, and Tumpowsky, at the meeting of the American Medical Association in June, discussed the significance of *hunger pain in chronic ulcer*. Ten cases from the Cook County and Michael Reese hospitals were examined. These were cases of clinically diagnosed peptic ulcer. The finding of strong contractions accompanying the pain of gastric ulcer led them to believe that the pain was due to tension. It was shown that marked hunger contraction caused pain in a hyperirritable condition of the stomach by increasing intragastric pressure. This condition explains the obscure conditions simulating ulcer, such as gall-bladder and appendiceal disease. Hyperacidity alone might be a factor by reflexly stimulating gastric hypertonus, hyperperistalsis, and pylorospasm. Subjective relief with alkalis might mean that alkalis prevented pain by neutralizing the causative factor producing gastric hypertonus. Pituitrin stimulated contractions, amyl nitrite abolished contractions probably by stimulating the inhibitory nerves and lessening reflex excitability. Hydrochloric acid of 0.5 per cent. had no appreciable effect. They do not feel justified, until further study is carried out, in discussing the effect of acidity of this phenomenon.

Gastric Contents. BACTERICIDAL PROPERTIES. The *Journal of the American Medical Association*, 1916, vol. lxvii, No. 4, p. 290, calls attention, in an editorial, to *bactericidal properties of the gastric juice*. It points out the well-known findings of Spallanzani and Koch. The former, even in the middle of the eighteenth century, pointed out that putrefying meat, when brought in contact with the gastric juice, failed

¹ American Journal of the Medical Sciences, 1916, vol. cli, p. 735.

to putrefy; while Koch will be remembered as having shown that cholera bacilli are destroyed in the stomach when the secretion is intact. He indicated, furthermore, that only in the presence of a disturbance in the gastric secretion did the organism implant itself on the intestinal tract. This thought is capable of great elaboration and in the above editorial we are reminded that cholera, typhoid bacilli, and the pyocyanous organisms are killed in this way, anthrax, tetanus bacilli (spore formers) and the tubercle bacilli pass through unharmed.

Recently, Gregersen¹ has studied this problem more thoroughly, using the gastric secretion obtained forty-five minutes after the administration of an Ewald meal and testing it toward various organisms. He found that *the bactericidal power varied directly with the free acid concentration and was not dependent on the combined acid or the pepsin*. Furthermore, the bactericidal action was three or four times that of a similar concentration of pure acid in water. This he explains as due to the bactericidal property of the bread used in the Ewald meal, which is activated by free hydrochloric acid. Solutions of bread in water produced very slight action, but the addition of pure acid, to the percentage approximating that of the gastric contents, resulted in an increase in bactericidal power to three or four times that of the two taken separately. That bacteria are constantly passing through the stomach is due to the rapid passage of water and foodstuffs in which free hydrochloric acid does not reach a sufficient concentration to exercise its bactericidal power.

We are in need of more pertinent editorials like the above-mentioned, and this question of intragastric disinfection requires far more study. In a recent article which I published in the Philadelphia number of *Medical Clinics*, I have pointed out the importance of the hydrochloric acid as one of the great barriers toward gastro-intestinal infection.

GASTRIC SECRETION. Wiltrup² discusses the results of the examination of the gastric secretion of 1000 patients. He is convinced that an increased secretion of mucus with an Ewald meal is abnormal and pathological. He believes that it appears before there is any disturbance of the pepsin mechanism. He says that with the more chronic forms the secretion of mucus is less, and that it is rare to find much mucus in advanced chronic gastritis with achylia and apepsia. The amount of mucus fluctuates from day to day, and the quantity is most pronounced in the exogenous types of gastritis. His tables indicate that anacidity is almost always associated with reduced, or lost, peptic power, and therefore hypopepsia is a sign of gastritis. This condition may have existed for some time before the hypopepsia manifested itself. Some of his cases indicate that hypopepsia is the only sign of an organic gastric disease. When mucus is present in considerable amounts with an Ewald meal, it is always a sign of gastric pathology. Acid gastritis is evident when normal acid content is associated with increased mucus formation. The peptic power then is normal or reduced. In 74 cases of polyarthritis, there was achylia in 26, hypochylia in 9, and the peptic secretion was normal in 37, while 2 had hyperacidity. In 77 suspected

¹ Centralbl. f. Bakteriöl., 1916, I, O., vol. lxxvii, p. 353.

² Hospitalstidende, Copenhagen, August 23, vol. lix, No. 34, p. 801.

cases of gastric ulcer there was hyperacidity in 19, normal pepsin findings in 72, and hypersecretion in 23.

Best¹ discusses the *fractional examination of the stomach contents*. He gives a resumé of the methods adapted, as well as the various test-meals used, and comments upon the fact that this method is deserving of much more attention. It becomes evident from contributions in this line that the results must be coördinated. In a contribution before the American Philosophical Society I described the normal response. The significance of the abnormal responses is such that, at the present time, no attempt will be made to coördinate these results.

Fishbaugh² contributes an interesting resumé on the fractional determination of gastric secretions. After discussing the technic he finds that the curves fall into three general classes:

I. Stomach secretions whose curves fall toward the end of gastric digestion.

II. Stomach secretions whose curves rise toward the end of gastric digestion.

III. Stomach secretions absent or delayed.

Group I. Secretions which fall toward the end of digestion. He says that the question arises as to why this phenomenon occurs. It would seem, according to the author, that two factors must be considered preëminently:

1. A portion of the acidity may be neutralized by the meal itself. A quantity of water crackers (which was the meal which Fishbaugh used) were well mixed with a standard solution of hydrochloric acid, tenth-normal, and allowed to stand at room temperature for varying lengths of time, when portions were filtered and the filtrate titrated against tenth-normal sodium hydroxide. It was found that this factor could be eliminated as a cause of the fall in the curve toward the end of digestion in the stomach.

2. During digestion the secretory activity in enzymes and acid is dependent on a stimulus, psychic, chemical or reflex, and as the stimulus disappears there would naturally be a fall in secretion. In this group of cases it would appear that such a condition was present and that, toward the end of digestion, the glands of the stomach continued to secrete, but produced a secretion decreasingly poor in enzyme and acid constituents, thereby diluting the once concentrated secretion and producing a fall in the curves.

We believe that the latter is the explanation and the former can almost always be discounted, inasmuch as the water with which the meal is made up is a true gastric stimulant, a point which can be readily shown by the water meal for example. The fall at the end of digestion is due to many factors: (1) Diminution in gastric stimulation, (2) regurgitation of pancreatic and duodenal secretions, (3) passage of the digestive secretion of high acidity into the duodenum and the establishment of the normal restive secretion or so-called gastric residuum, and possibly by dilution with a late secretion which resembles a diluting fluid more

¹ Journal of the American Medical Association, 1916, vol. lxvii, No. 15, p. 1083.

² Ibid., No. 18, p. 1275.

than a true acid secretion. These points require further investigation before we can definitely settle them.

Group II. Curves which rise toward the end of digestion. In this group, by no means infrequent, the author gives examples and asks the pertinent question as to which type is normal? Clearly in this type, characterized by its continued secretory phenomena, there is an acceleration of the digestive secretions toward the end of digestion, and a direct antithesis of the factors which have more or less abruptly concluded the secretory manifestations seen in the previous type.

Group III. He divides this group into three classes:

1. The absence of acid and enzymes.
2. Absence of acid with enzymes present.
3. Enzymes and acid appearing late in the cycle of digestion.

The first is a true achylia gastrica, and the author considers this rare, a finding which, after many thousands of examinations in this way, I am inclined to agree with. The absence of acid with the persistence of enzymes is a more frequent finding. The third group represents the form of "delayed" digestion, in which presumably the psychic secretion was absent, but the chemical was persistent. As the author points out, and I have on previous occasions discussed, this group would be classed with the achylia unless its true significance was revealed by fractional technic. In his summary he claims that the one-hour examinations afford insufficient, and often misleading, information concerning the acidity and enzyme secretion. It gives no evidence of the secretory curve. Other contributions have appeared on this subject.

Classification of Gastric Conditions. CHRONIC GASTRIC DISEASE: *Diagnostic Groups.* Cheney¹ discusses the question of the classification of chronic gastric disease. He believes that it is of value to divide the chronic gastric conditions which we meet into 5 groups, as follows: (1) Gastric cancer, (2) gastric and duodenal ulcer, (3) chronic gastritis, (4) gastropptosis, (5) gastric neuroses. He places the cancer group first because, in his words, it is the most definite, and affords the least opportunity for error. Emphasis is placed on the difference in the symptoms depending on the localization of the neoplasm. It seems to me, however, that the early diagnosis of gastric carcinoma is today the most serious, most important and apparently least understood problem in gastrointestinal medicine. In enumerating the above groups I should place gastric cancer last because it is exactly before the classical symptoms which Cheney points out that we wish to diagnose the disease. Cheney does not differentiate between gastric and duodenal ulcer, because he says, "in etiology and pathology, gastric and duodenal ulcer are identical." We are not prepared to accept this dictum, although in diagnostic classification it is probably wise to include both of these conditions in one group. One rather interesting point in his series is the comparative infrequency of hematemesis, only 11 out of 92 cases showed this finding.

The group comprising chronic gastritis is the most uncertain of all the chronic gastric conditions, because there is such a multitude of etiological

¹ Journal of the American Medical Association, May 19, 1917, vol. lxviii, No. 20, p. 1464.

factors and likewise a number of forms of the disease. The feeling of distress after eating is not alone confined to chronic gastritis, nor is the distention, bloating or gas formation or swallowing. In a certain proportion of cases there is nausea or vomiting; in others this symptom is entirely lacking. Cheney points out, however, that vomiting is a much less frequent manifestation of chronic gastritis than text-books have led us to believe, and that agrees entirely with my experience. I have examined many cases of this disease in which nausea and vomiting were entirely lacking. The association of reflex symptoms in this group is emphasized by Cheney: Morning headache, dizziness, depression of spirits, drowsiness after meals, lack of energy and general indisposition for exertion. These symptoms, so thoroughly emphasized by the French as diagnostic of chronic gastritis, seem to me to be traceable to an associated hepatic or intestinal condition rather than gastric catarrh, and it is a fact, which more recent study has shown, that chronic gastritis as a disease simply affecting the stomach is extremely rare. Nearly always there is a disturbance of the whole upper digestive tract.

Discussing the group known as gastric neuroses, Cheney has added nothing to what we already know, and whether or not we are justified in preserving the term gastric neuroses depends entirely on the result of painstaking research which in the future will demonstrate just how far secretory and motor disturbances, without any demonstrable organic change in the stomach, are due simply to disturbances in enervation or to widespread metabolic, chemical, and physical conditions which we shall be able to understand and classify. The objections to Cheney's classifications are that it is too broad, that with the single instance of gastric cancer and perhaps gastric and duodenal ulcer, the conditions overlap each other and offer us no real aid to the solution of the problem. We are in need of an intelligent classification of both acute and chronic gastric conditions, but such a classification must enable us to appreciate fully the possibilities of the situation. The possibilities of chronic gastritis, the fact that gastropptosis is only part and parcel of a general visceroptosis, the possibilities of chemical changes, chronic infections, chronic motor disturbances, other than those due to ulcer, atony and dilatation are more than gastropptosis, benign neoplasms other than gastric cancer all deserve a place in any satisfactory classification of chronic gastric conditions. Furthermore, it seems to me that any classification of chronic gastric conditions should start with the first important subdivision of primary and secondary conditions of the stomach.

It seems to the author that gastric conditions are so frequently bound up with conditions in various parts of the body that any classification which does not consider these possibilities ought to be rejected. Renal disturbances by nitrogen accumulation produce a definite form of disturbance; ductless gland anomalies, by alteration in both the secretory and nervous mechanism, produce other forms of diseased gastric conditions; pulmonary tuberculosis both by way of the alimentary tract and by way of nervous paths produces another form of the condition, and so we could go on enumerating gastric conditions. It seems to us that the primary classification of chronic gastric states should include

intra- and extragastric terms which have every justification for their use and which should be uppermost in the mind of the clinician. Cheney apparently has discussed the intragastric conditions, but these alone are but a small proportion of the chronic gastric conditions we meet. Either we must adopt a rigid clinical and etiological classification, or confine ourselves to an equally rigid classification founded on chemical, bacteriological, and pathological facts. This subject is one worthy of extended study, inasmuch as our classification at present must be entirely altered regarding gastric conditions. Hyperacidity, hypersecretion, and particularly chronic gastritis are conditions which must eventually be classified under their proper heads, and not under the camouflage which these terms attempt to give.

Autonomic Imbalance. The question of *vagotonia* and *sympathicotonia* has received no special mention in the last year, nor are we any closer to recognizing, except clinically, the perturbations in this system. Faber and Schou¹ report the results of their tests of the vagus and sympathetic system by means of atropine, pilocarpine, and epinephrin. Their results are rather disappointing and confusing, and only lend color to the fact which is now universally recognized that these symptom-groups are almost always associated, and a pure disturbance rarely exists alone. No antagonistic action, such as Eppinger and Hess postulate, could be discovered between the different drugs. Sixteen responded with equal promptness to pilocarpine and epinephrin; the response to both was weak in one; in the others the response was somewhat more lively to one than to the other, but, in all, the reactions to both paralleled each other more or less completely, regardless of the individual pathological condition. Nothing was found which could distinguish vagotomy from sympathicotony. In one table he gives the results of the subcutaneous injection of epinephrin in 41 cases. The blood-pressure increased from 35 to 47 per cent. in 19 men, and from 9 to 43 per cent. in 20 women, but the increase averaged only 8 per cent. in 2 men with cirrhosis of the liver and ascites, which fact is cited as significant. The sugar content of the blood increased after subcutaneous injection of 0.7 mg. of epinephrin much the same as with alimentary hyperglycemia; the charts of averages of each are practically identical, both in normal persons and those with signs and symptoms.

Infection. We are daily becoming more imbued with the idea of *infection as applied to chronic gastro-intestinal diseases*, and the last year has resulted in several communications which should receive careful consideration. McGarrison's work on the etiology of endemic goitre strongly indicates that thyroiditis is the result of infection from the alimentary tract, and this is strengthened by Rosenow's successful isolation of bacteria from this gland; the organisms he found—*Bacillus welchii*, *staphylococcus*, and *streptococci*—all being found in the alimentary tract. The contribution of most interest to us, however, is that of Rosenow² on the causation of gastric and duodenal ulcer by

¹ Ugesk. f. Lager, Copenhagen, May 18, lxxviii, No. 20, p. 785; abs., Journal of the American Medical Association.

² Journal of Infectious Diseases, 1916, vol. xix, p. 333.

streptococci along the lines of the elective localization of these organisms enunciated by that author some time ago.

The technic of making cultures from ulcer is described in a previous paper.¹ In this paper, however, Case 773, in which duodenal ulcer from operation was cultured, staphylococci isolated failed to give ulcer on inoculation, while injection of the streptococci isolated produced ulceration. Case 779, operated ulcer, gave positive streptococci in both ulcer base and in the lymph gland, injection in dogs producing ulcer. The same was true of Case 884. In Case 52, who died and showed ulcer of the duodenum, streptococci isolated from the teeth produced ulceration in 3 out of 4 animals injected. Case 236 who had ulcer of the stomach as well as infected teeth with sinus formation, injection of the *Streptococcus viridans* recovered from the sinus had a pronounced ulcer-producing effect in laboratory animals. In Case 531, with recurring tonsillitis and ulcer of the stomach, extirpation of the tonsils was practised, and on culture these organs gave chiefly *Streptococcus viridans*, a few hemolytic streptococci, streptococci injections of which produced ulcer in laboratory animals.

These results are briefly enumerated because they point out strikingly the supposed etiological association between foci elsewhere and lesions in the stomach. In a previous paper the same author² had pointed out that when strains of streptococci of low virulence are passed successively through animals, their place of localization changes with returning virulence and when these strains reach the stage at which they give rise to muscle lesions, they are apt to produce ulcer of the stomach and focal nephritis.

In his summary he says, "Ulcers produced by the injection of streptococci resemble those in man in location, in gross and microscopic appearance, and in that they tend to become chronic, to perforate, and to cause severe or fatal hemorrhage.

"Streptococci, having a characteristic affinity for the stomach and the duodenum, have been repeatedly isolated from various foci of infections in patients with ulcer and in ulcers themselves. They tend to disappear from the circulation and do not commonly produce marked lesions elsewhere. They have been isolated from ulcers in animals, and ulcer has again been produced on their reinjection. Filtrates of these cultures show no special tendency to produce ulcer. The necessary requirements have been fulfilled to warrant the conclusion that the usual ulcer of the stomach and of the duodenum in man is primarily due to a localized hematogenous infection of the mucous membrane by streptococci."

His reasoning is such that it seems to me justifiable to give the points in the discussion, as follows:

"The results of Türek on the production of ulcer in animals by the injection and feeding of colon bacilli, possibly applicable to some ulcers, in the light of these findings have little bearing on the chief problem of ulcer of the stomach and of the duodenum in man. Colon bacilli

¹ Rosenow and Sanford: *Journal of Infectious Diseases*, 1915, vol. xvii, p. 219.

² *Ibid.*, 1914, vol. xiv, p. 1.

are rarely found in ulcer in man during life, and, if Turck's feeding experiments have a bearing, ulcer of the stomach should occur chiefly in persons with profound inanition, the result of improper and insufficient food and unsanitary surroundings.

"Since streptococci from certain foci of infection in patients with ulcer tend to produce ulcer of the stomach in animals, might not the frequency of ulcer in the male sex, in certain localities, and during the winter months, be best explained on the basis of the high incidence of throat and other infections? Such infections afford opportunity for streptococci to acquire affinity for the stomach and to gain entrance into the blood stream.

"The ulcers produced in my experiments, just as do spontaneous ulcers in man, tend to heal in the fundus, and to become chronic in the pyloric portion, the lesser curvature, or the duodenum. While the elective affinity of the bacteria for the gastric mucous membrane is the primary cause of the ulceration, certain contributing factors play a definite role in making for the chronicity of the ulcer.

"The digestive action of the gastric juice has been repeatedly put forth as a cause of ulcer and as the chief factor in preventing the healing of ulcer. But this is improbable, inasmuch as recent röntgenological studies have shown that hyperacidity and violent spasms may be present over a period of years from causes outside the stomach without the development of ulcer. Ulceration does not occur along the segment of the stomach thrown into violent spasm directly opposite a chronic ulcer. The promptness with which defects of the stomach heal after excision, after injection of corrosive chemicals, after interference with the blood supply, and after operations, shows how unimportant is the action of the gastric juice. The fact that ulcer occurs with achylia gastrica also supports this view.

"Some ulcers in man may be made to heal when the acidity is reduced by the administration of alkalies, as advocated especially by Sippy, or by the alkaline contents of the duodenum, following gastro-enterostomy. Might not the good effect be due to an alkalization of the tissues throughout the body, rather than wholly to local action? The direct digestive action of the hyperacid gastric juice on the floor of the ulcer is believed to prevent healing. If this is true, chronic ulcer should be found where this action proceeds for the longest time and is most direct; that is, in the acid-secreting portion of the stomach. This is not the case. No matter how prolonged or increased the action of the gastric juice, the fact remains that its corrosive action must be less in the duodenum than in the stomach, probably is appreciably less in the pyloric segment and in the lesser curvature, the common sites of both experimental and spontaneous chronic ulcers. Something with greater penetrating power than the gastric juice must first damage the cells before they can be digested.

"Clinical, röntgenological, and experimental studies on the physiology of the stomach prove conclusively that ulcers along the lesser curvature, in the pylorus, and in the duodenum, are especially prone to be associated with abnormal motility of the stomach and spasm of

the pylorus, resulting in delayed emptying, hypersecretion, and hyperacidity. This peristaltic unrest produces mechanical injury, necessarily greatest in the relatively fixed points where chronic ulcer occurs, prevents physiological rest, and hence serves to maintain the primary infection in the margin of the ulcer, at the same time increasing the liability to secondary infection. This mild, but long-continued, traumatism appears to be of greater importance in preventing healing than the direct corrosive action. Infection and infiltration of connective tissue are favored, resulting ultimately in the calloused crater-like ulcer, which, for mechanical reasons, cannot heal even though the infection is reduced to a minimum or completely overcome.

"This conception is in accord with the results obtained by Bolton who showed that partial closure of the pylorus delayed the healing of ulcers produced by the injection of gastrotoxic serum, but only of those which became septic. It is in accord with Bolton's more recent results in which he again showed that delayed healing of ulcer occurred chiefly in those animals in which the obstruction at the pylorus was so marked as commonly to cause death, and in those which were given abnormal concentrations of hydrochloric acid. It is not at variance with the results of Hamburger and Friedman, who showed that partial obstruction of the pylorus, resulting in extreme hypermotility and dilatation, delayed the healing of ulcers produced by the local injection of silver nitrate, particularly in the pyloric portion. It is in accord with the results of Durante who produced ulcers by ligating the splanchnic nerves. The ulcers shown by him to be chronic, present evidence of infection. If Durante had searched for bacteria, he would undoubtedly have found them, because, in one of the chronic ulcers, I demonstrated (after publication of his paper) not less than 50 cocci and diplococci in the depths of the tissue which showed leukocytic infiltration; moreover, no bacteria could be found in the healing ulcer from the same stomach which showed no leukocytic infiltration.

"Might not this conception best explain the etiological relationship to ulcer of the vagotonic or neurotic state in general, as emphasized especially by Westphal and Katsch, Gunderman, and Eppinger and Hess? Disturbed motility and spasm of the stomach and hyperacidity, occur commonly in neurotic persons.

"Moreover, if the lesions of the autonomic nervous system are ever a cause of ulcer, as emphasized by Durante's experiments, then it may be suggested, in the light of researches by Oftedal and myself on herpes zoster, and other more recent experiments, that streptococci or other bacteria or their toxic products may be the cause of lesions of the autonomic nervous system.

"In support of the view that ulcer of the stomach in the adult is due to streptococci, it should be stated that Gerding and Helmholtz, by the use of the same methods, have not only shown that a recent epidemic in Chicago of duodenal ulcer in infants was due to streptococci but in restudying the sections of ulcers from a similar epidemic in Berlin, reported by Helmholtz seven years ago, they have demonstrated streptococci in all but 4 of the 14 ulcers available. Furthermore, in a study

of the etiology of spontaneous ulcer of the stomach in dogs, calves, cattle, sheep, in conjunction with Hart and Henderson (as yet unpublished), it appears that ulcer in these animals also is due to a commonly circumscribed streptococcal infection.

"The occurrence of acute ulcer of the stomach and exacerbations of the symptoms in chronic ulcer in connection with foci of infection; the improvement in symptoms following removal of foci of infection; and the development of new ulcers after excision of the ulcer in patients in whom chronic suppurating foci have not been removed—all strongly suggest the etiological relation between remote foci of infection and ulcer. None of these observations, however, proves the etiology of ulcer. The demonstration of streptococci in the foci of infection in patients with ulcer and in ulcers themselves, and the fact that they localize in the stomach in animals, furnish what seems to me to be the final proof of the etiology.

"The conditions under which streptococci acquire affinity for various organs are still obscure, but of the existence of this affinity of streptococci in diseases there is no question. The fact that in some instances streptococci were isolated from relatively insignificant foci of infection, and the fact of their presence in patients with ulcer over a long period suggests, as I already pointed out, 'that differences in the host may afford the peculiar type of reaction, or the individual harbors a particular focus of infection which is favorable for bacteria to acquire the various elective properties.' These observations suggest strongly that while removal of evident foci of infection is important, cure should not always be expected.

"The periodic occurrence of exacerbations in symptoms followed by quiescent intervals in chronic ulcer would seem to be best explained on the basis of infection, the former being due to a lighting up of the dormant infection or to reinfection from a focal source when immunity is low and the latter to quiescence of the infection, the result of heightened local or general immunity."

These observations are of the greatest importance and should set us to thinking. I am not convinced of the "infection" theory of ulcer in spite of the brilliant reasoning and excellent data deduced from these experiments. It was my privilege to study some phases of the ulcer question under the auspices of the Carnegie Institution, and we were then able to produce ulcer in laboratory animals with a great variety of non-bacterial substances, chemical and pharmacological toxins differing widely in their effects. These ulcers were similar to those produced by Bolton with his gastrototoxic sera, and were very similar to the lesions which Rosenow has produced and which I saw in Boston several years ago. It is my belief that there are many etiological causes for ulcer and that no one etiological factor will explain all. Examination of the residuum on the empty stomach will, in many instances, disclose streptococci, and it would seem to be a relatively easy matter for these acute ulcers to become chronic through secondary infection, which might occur at the moment of their formation. Rosenow's conclusions, however, are of the greatest value, and I, for one, am disposed to partially

accept them, not as a complete explanation of the causation of ulcer, but as one of the important contributing factors.

It is therefore not unreasonable, in the light of the above studies, to see clinicians treating ulcer by autogenous vaccines prepared from distant foci of infection. These vaccines consist of the isolation of organisms from foci of infection in the nose, throat (tonsils, pyorrhoeal pockets, etc.) and then their administration to the patient. Furthermore, culture of the excised gall-bladder and appendix has been tried. Much more will be heard of these methods of treatment in the future as well as the alleged specificity of certain organisms, as the streptococcus and the colon bacillus in ulcer formation. I would point out one thing, however, and that is the frequency of actual intragastric infection, which I have described in a communication about to be published. The method of diagnosis by fractional technic is also described, as well as the method of intragastric sterilization. While it is true that the hematogenous route may explain many infections, others can be traced to swallowed infected material in stomachs which are physiologically below par and have lost their ability to resist infection—namely by reduction in secretory output, disturbances in motility, and actual changes in the gastric mucous membrane.

Spasm of the Stomach and Duodenum. This condition has worried many observers and is worthy of the most careful study. It was thought that when the subject of vagotonia and sympathicotonia was investigated, we would find simple methods for studying the irritability of the vagus and the sympathetic plexuses. However, no real advance has been made in this field, and we still lack satisfactory clinical methods for estimating the degree of spasm or atony of the smooth musculature of the gut, and, more confusing still, is the unquestioned association of spastic and atonic phenomena in the same individual.

Carman¹ contributes a röntgenographic study of spasm which is worthy of review. He points out that spasm of the stomach is either intrinsic or extrinsic, intrinsic in that it is due to an intragastric lesion, extrinsic those due to lesions outside the stomach. Spasm of the stomach due to an intrinsic lesion is generally due to ulcer, but may be associated with cancer. Three forms of spasm due to ulcer may be distinguished: (1) The incisura or hour-glass stomach, (2) diffuse spastic distortion of the stomach, (3) spasm of the pyloric sphincter (pylorospasm). The incisura is a spastic contraction of the circular fibers on a plane with the ulcer and shows an indentation of the opposite curvature, which, when deep, produces the bilocular or hour-glass stomach. Frequently, ulcer of the stomach is accompanied by diffuse gastric spasm (gastrospasm) affecting a considerable portion of the pyloric segment. Finally, the form with pylorospasm shows six-hour barium or bismuth retention. He points out the interesting fact that cancer may be accompanied by spasm.

Extrinsic conditions, such as ulcer of the duodenum, gall-bladder and appendiceal lesions produce spasm, usually localized and regional.

¹ Journal of the American Medical Association, April 22, 1916, vol. lxvi, No. 17, p. 1283.

but occasional extrinsic causes can induce almost total gastrospasm characterized by gastric hypertonus which far exceeds the physiological limits. This picture under the *x*-rays resembles some of the extensive deformities produced by scirrhus cancer. Other extrinsic causes which have been noted are hysteria, pancreatic disease, tabes, arteriosclerosis affecting the abdominal viscera, renal and ureteral calculi, uremia, and poisoning by lead, nicotine, and morphine.

Spasm resulting from ulcer or cancer is persistent and unvarying. With it, if frequently seen, the *x*-ray evidence of the condition, such as the nichen symptom or the defect in filling. The indirect, or extrinsic form is often brief in duration and intermittent in appearance. Belladonna or its alkaloid, atropine, seems to have almost no effect on the intrinsic type, while in the extrinsic type, tincture of belladonna in the dose which Carman recommends, 15 to 20 drops three times a day for several days, reëxamining at intervals, causes a disappearance of the condition. He insists upon the fact that the patient shall show the physiological effects of the drug as well.

There is also frequently associated with ulcer of the duodenum spasm which has its origin almost always, as Carman points out, in an actual duodenal lesion. In other words, Carman does not take much stock in spasm of the duodenum due to extrinsic causes, although duodenal lesions will frequently cause spastic phenomena in the stomach.

Exfoliating Gastritis. Van Leersum¹ discusses the question of exfoliating gastritis. He makes a practise of examining the gastric lavage water for the presence of pieces of mucosa and has found in the last two years eighty-eight pieces, nine of which were from one patient. The important point is that the diagnosis of exfoliating gastritis is only made when these fragments are found on repeated occasions. There is pain in this condition, but it is mentioned as being less than that of ulcer (?). The gastric secretion is usually low in acidity, although he never found achylia, and while it resembles that of gastritis, the material removed is more fluid than that of gastritis. A point regarding the condition is that for weeks or months the stomach may be apparently normal.

The stomach must heal quickly after these fragments are removed, as serious hemorrhage has never been seen with this condition. In the treatment, overheated foods, spices, and mechanically irritating foods are entirely removed from the dietary, and medication consists in using an astringent, such as silver nitrate, directly on the mucous membrane. He has the patient take, before meals, 15 c.c. of a solution of 0.5 gram of silver nitrate in 300 c.c. of distilled water. The patient must be warned not to take this without medical control, inasmuch as he has noted silver poisoning after taking as little as 2 or 3 grams. The nails and gums show the first signs of argyria. Discoloration of the skin occurred in one patient who had used 6.7 gm. of silver nitrate in the course of three years.

All food should be in purée form and avoid taking liquids too hot.

¹ *Nederlandsch Tijdschrift voor Geneeskunde*, Amsterdam, May 6, vol. i, No. 19, p. 1589.

Gastric Conditions Due to Nitrogen Retention of the Blood Serum. This is by no means a new conception and has been described on various occasions, but the significance of nitrogen retention, as measured by various laboratory procedures rather than the simple association of renal disease, is one which is worthy of note. Castaigne some time ago described the hypersecretory phenomena associated with chloruremia or salt retention.

Chace¹ gives an account of 22 cases of nitrogen retention due to chronic nephritis, 10 of which died. A tabulation is made of those cases which gave gastric symptoms, together with the uric acid, urea, and creatinin-nitrogen content of the blood serum. It is not surprising that very early cases of nephritis, as Fisher and others have pointed out, should show a retention of uric acid without any corresponding retention in urea or creatinin, while cases in the last stages should be the only ones in which a decided increase in creatinin is encountered. Following that scheme, therefore, he divided his cases into those in which high creatinins were a feature and those in which high uric acid was the prominent feature. This arrangement has been made owing to the fact that the retention of creatinin is a great prognostic sign in nephritis, while uric acid is principally of value as an early diagnostic sign. The similarity in the 10 fatal cases, so far as their gastric symptoms were concerned, is rather striking, namely—vomiting and epigastric pain; while in the non-fatal cases, vomiting, gaseous eructations, with both diarrhea and constipation, were found. In cases with obscure gastric disturbances, the chemical examination of the blood has been found very valuable.

The Possibility of Lowering Gastric Acidity by Means of Diet. P. I. Denisova-Suchevskaja² cites a large number of authors to show a division of opinion with regard to the effect of diet on hyperacidity. While some gastro-enterologists assert that a diet rich in meat and eggs diminishes hyperacidity by combining with the free hydrochloric acid, others maintain that such a diet stimulates gastric secretion and recommend a carbohydrate and hydrocarbon diet as the most suitable. Still others are of the opinion that diet has no effect one way or the other, the point of greater importance being the quantity of food given. His own conclusions are that a diet of vegetables and fats is of value in the treatment of hyperacidity because it remains in the stomach for a short time and does not stimulate gastric secretion, but brings about a permanent reduction of acidity. These conclusions are based on observations made in Professor Iarotzky's clinic. The diet, as recommended by Professor Iarotzky, consists of the whites of 3 or 4 eggs in the morning and 60 to 80 grams of butter in the afternoon. In a day or two the whites of 2 eggs and 40 grams of butter, unsalted, are given in addition, increasing so that in about a week the patient receives the whites of 8 eggs and 140 to 160 grams of butter daily. This diet contains about 1700 calories. In severe cases, and in gastric ulcer, the treatment is begun with the white of 1 egg and 20 grams of butter daily. Under this diet the

¹ American Journal of the Medical Sciences, 1917, vol. cliii, p. 801.

² Russkiy Vrach, July 9, 1916; abs., New York Medical Journal, 1916, p. 1165.

patient neither asks for, nor receives, water. If thirst is excessive, enemas of sugar in water are given. In about ten days or two weeks the whites are reduced to 3 or 4, the butter to 60 to 80 grams and a limited amount of carbohydrates and fats added. These consist of purée of potatoes, rice, farina, and oatmeal with butter. Later, vegetables well-cooked and mashed, with the addition of butter, but without salt, added. A number of cases are described in detail, showing that this dietetic regime brought about a marked reduction of the hyperacidity and improvement of the symptoms.

Achylia Gastrica. Andresen¹ contributes an interesting study on achylia. In discussing the ETIOLOGY, he considers: I, abnormalities in the gastric glands; II, abnormalities of the blood; III, abnormalities in the nervous system.

I. *Abnormalities in the gastric glands* producing achylia may be of three kinds: (1) Functional, a condition in which normal glands do not produce a normal secretion, this he considers infrequent; (2) inflammatory conditions of the gastric mucosa, (a) catarrhal, as the result of chronic irritation from the ingestion of alcohol or nicotine to excess, or improper or insufficiently masticated food; (b) infective, as the result of primary foci of infection elsewhere causing a general inflammatory condition of the gastric mucosa (89 per cent. of his cases showed infections of the mouth, nose, and throat); (3) atrophy of the gastric mucosa as shown or rather produced by (a) chronic inflammation as the above; (b) arteriosclerosis with attendant sclerosis of the mucosa; (c) new-growth pressing upon or destroying the secreting cells, such as carcinoma, sarcoma, fibroma, gumma, or extensive scar tissue from chronic ulcer; (d) distant wasting diseases, such as tuberculosis, intestinal parasites, chronic malaria, diabetes, plumbism, sprue, pellagra, etc.

II. *Diseases of the blood*—might interfere with the carrying of enzyme activators or HCl producers. They include: (1) Anemias and leukemias, pernicious anemias, and chronic gas poisoning with its gas destruction of the blood; (2) so-called gouty conditions and intestinal and other toxemias; (3) syphilis, tuberculosis, or any form of septicemia; (4) diseases of the glands of internal secretion.

III. *Abnormalities in the nervous system*, tabes, vagotonia, and sympatheticotonia [only the later—*Reviewer*] as well as chronic infected conditions in other parts of the body acting through the nervous system. A simple explanation would be, although it is not completely substantiated, that with the exception of those congenital cases and those due to tumor or disease of the glands of internal secretion, it is always due to a chronic generalized hematogenous infection of the gastric mucosa, probably by the *Streptococcus viridans* as the result of a primary focus of infection elsewhere. They have used my fractional method in 190 cases, 19, or 10 per cent., showing true achylia. In recent studies we have found the incidence of total anacidity from 8 to 10 per cent., being larger in hospital practice, which would tend to incriminate infection.

¹ Medical Record, November 11, 1916.

The prognosis of this condition naturally depends upon the cause, the author's finding, which is corrected, is that only a comparatively small number show complete recovery in secretion. This is true of the chronic achylia. Apparently there was a typographical error in the text, as in the reprint, the author has corrected this.

(I have reported at the last meeting of the American Medical Association some studies on achylia, showing that in almost every instance the disease is not confined to the stomach, and involves the bowel. In that same paper I reported a number of cases from a very much larger number of achylia cases, in which there was a return of the secretion.)

TABLE A. OTHER CONDITIONS LIABLE TO CAUSE ACHYLIA.

Disease	Number	Per cent.
Pelvic disease	11	17.0
Chronic alcoholism	10	15.0
Tuberculosis	10	15.0
Cardiovascular-renal disease	8	11.0
Gastric carcinoma	6	9.0
Gall-stones	3	4.5
Appendectomy (postoperative)	3	4.5
Goitre	3	4.5
Diabetes	2	3.0
Chronic malaria	2	3.0
Chronic gas poisoning	2	3.0
Miscellaneous	6	9.0
Total	66	100.0

TREATMENT OF ACHYLIA. The indications for treatment in achylia gastrica group themselves under the following general heads:

1. "The removal of an infected foci, which, in addition to being a probable etiological factor in the disease, tend to weaken the patient's reconstructive powers, so necessary to an effective cure. Operative treatment of such an infected foci in the mouth, nose and throat and accessory sinuses, abdomen, pelvis or any other part of the body should be preceded, if possible, by a course of dietetic and tonic treatment, and the use of autogenous vaccines of the *Streptococcus viridans*, obtained from these foci of infection. This procedure would tend to prevent complications when operation would throw into the circulation large amounts of infective material. If the infective theory is correct, the use of the vaccines might also be of some theoretical value in hastening improvement in the condition of the gastric glands. In the few cases in which we have tried this method, improvement in the patient's condition seemed more rapid and more complete than in those where it was not used."

2. "The treatment of any constitutional abnormality complicating or possibly acting as a causative factor in the achylia. This would include treatment of the anemias, leukemias, malaria, syphilis, tuberculosis, cardiovascular and renal diseases, rheumatic conditions, alcoholism, etc. In addition to treatment specific for any of these conditions, tonics would be indicated. I have been in the habit of combining ferric chloride and calcium chloride with the hydrochloric acid usually given

in this disease. The use of the so-called bitter tonics before meals may in some people have some effect in stimulating the appetite, but no effect on the gastric secretion may be expected, as shown by the recent researches of Carlson and others. The best tonic after all is a proper diet, and this will be discussed later in detail. Exercise, especially in the fresh air, gymnastics, baths, and change of scene are of value. Abdominal massage and electricity may be used."

3. "The treatment of the diseased stomach must have as its keynote the conservation of its motor function. With the secretory function impaired, the motor function is of the utmost importance, and any measures, such as overfeeding or overdistention by careless lavage, should be avoided. Lavage was formerly a very popular procedure, but has more recently been practically abandoned. The amount of mucus removed by this method is probably more than compensated for by the subsequent increased secretion of mucus by the irritated stomach. A tumblerful of hot water given one-half hour before meals has a cleansing effect, besides being a valuable addition to the diet. Mineral waters are not necessary, but, where given, should be those which contain sodium chloride as a principal constituent. Mineral oil, given in tablespoonful doses, morning and evening, is soothing to the irritated gastro-intestinal mucosa, and besides being of value in relieving constipation, is not contra-indicated in diarrhea."

4. "Dietetic treatment: The diet should be concentrated, and should consist of small amounts of food frequently repeated, preferably every two and one-half or three hours. The food should be in such form as to cause the least possible irritation to the diseased mucosa, and to require little or no alteration to make it digestible, by the intestinal secretions. To prevent putrefaction, it is best at first not to allow any kind of meat. For the same reason eggs should not be allowed unless soft-boiled and then only in moderation, not more than one a day. It is better to derive the necessary protein of the diet from vegetables, or from nuts in moderation. Gelatin is also valuable as a protein sparer. Milk should be an important part of the diet, and it is well borne except in some diarrheal cases, where it seems to cause more irritation of the bowel. Frequently, however, this tendency to irritation can be overcome by having the milk peptonized or acidulated with dilute hydrochloric acid, one dram to a glass of milk added just before the glass of milk is taken. It has been our experience that buttermilk and artificially soured milk is not borne well.

"Carbohydrates form a valuable part of the diet in these cases. Starches are best given in such a form that the protein envelope, which requires digestion by the gastric juice, shall have been broken. For this reason strained vegetable soups, or purées of potatoes, peas, beans, lentils, spinach, or carrots, are valuable. Thoroughly cooked cereals and puddings, served with cream or with stewed fruits, or fruit juices, are tasty and easily digested. Flaked or shredded cereals are also good, as are bread, toast, and simple crackers. The so-called 'vegetable meat' preparations made of vegetables and nuts, provide an agreeable variation to the diet. Sugars are of value, but must be taken

in moderation to avoid acid fermentation in the bowel, as evidenced by sour stools. The less fermentable sugars, such as lactose or maltose, may be added to the diet to increase its fuel value.

"Fats and oils, in the form of butter, cream, olive oil or yolk of egg, are good to add to the caloric value of the diet, and also tend to soothe the irritated gastric mucosa. Taken to excess they are bad, especially in the presence of diarrhea.

"Beverages besides milk which may be allowed include cocoa, weak tea, or coffee, or, better, cereal coffee substitutes, and fruit juices. The use of alcohol in any form should be interdicted, as should be the use of tobacco.

"In a general way the diet should consist of between 2000 and 3000 calories, a little more than the amount required in the average normal person. The best index of a proper diet is the patient's weight. In a debilitated, undernourished patient, an increase in weight is necessary; in no patient is loss of weight during treatment admissible. A good sample diet for a single day, consisting of 2515 calories, is shown in Table B. By varying the nature and quantity of the different constituents, such a diet can be made acceptable, or even agreeable to the patient."

5. "The use of hydrochloric acid and enzymes is a subject about which there is still considerable controversy. Probably the most valuable aid in relieving the symptoms of achylia gastrica is the use of hydrochloric acid. While this acid cannot of necessity be given in such quantities as to ensure a concentration in the gastric contents even approaching the normal, its effect, even in small doses, is remarkable. The distress and sour regurgitation after eating are very quickly relieved. Vomiting usually ceases at once, and diarrhea, in my experience, has been always controlled within a few days, being often followed by obstinate constipation. The beneficial effects following the use of hydrochloric acid can be ascribed to the fact that its ingestion produces effects similar to those produced by the normal acid in the stomach, *viz.*, a stimulation of gastric, intestinal, and pancreatic secretion, a changing of proenzymes into active enzymes, an improvement of amylorrhesis by aiding in the digestion of the starch envelopes, and the antiseptic action. The dose of the acid should vary from fifteen drops to one teaspoonful or more of the dilute hydrochloric acid, preferably beginning with larger doses and reducing their size as symptoms are ameliorated. It should be given one-half hour after eating, well diluted with water, and swallowed through a tube to avoid burning the teeth. By dissolving one teaspoonful of cane-sugar, in the wine-glassful of water, retching of the oral mucosa can be further avoided. A substitute for the acid, supposed to be less disagreeable to the patient, is acidol, a hydrochloride of betain, which is said to form nascent hydrochloric acid on reaching the stomach. The dose is from 10 to 30 gr., each grain representing one minim of hydrochloric acid. It is expensive and not much better liked by patients than the very cheap acid, given as above described."

TABLE B.

BREAKFAST.		Quantity.	Calories.
Apple sauce	4	ounces	75
Milk	6	ounces	125
With cocoa or lactose	$\frac{1}{2}$	ounce	40
Cereal	4	ounces	75
With sugar	1	dram	25
With cream	1	ounce	50
Egg poached on toast	1	egg, 1 slice	150
Bread and butter	1	slice	65
			— 605
10.30 A.M.			
Milk	6	ounces	125
With lactose	$\frac{1}{2}$	ounce	40
Graham crackers	2	small	10
			— 175
LUNCH.			
Cream vegetable soup or purée	5	ounces	125
Milk and lactose as above	6	ounces	165
Bread and butter	1	slice	65
Bread or chocolate pudding	4	ounces	200
			— 555
4 P.M.			
Milk and lactose, and Graham crackers as above			175
			— 175
SUPPER.			
Potato or tomato bisque soup	4	ounces	75
Fresh asparagus	1	ounce	25
Raw cabbage salad	2	ounces	50
Bread and butter	1	slice	65
Milk and cocoa or lactose as above			165
Gelatin with cream	4	ounces	50
			— 430
ON RETIRING			
Milk, lactose and Graham crackers as above			175
			— 175
AFTER EACH MEAL.			
Olive oil	$\frac{1}{2}$	ounce	400
			— 400
Total number of calories			2515

Fischer¹ discusses the question of the treatment of achylia. He emphasizes the complexity of the disturbance and the necessity of considering the various factors involved. There may be a disturbance in the digestion of either the fats, proteins, or carbohydrates, but, as a rule, all three are involved, and the principle in the treatment is to save the bowels as much as possible. Buttermilk, whey, kefir, and milk-sugar render important service, as well as massage, hydrotherapy, and oil enemas. Small frequent meals are indicated, and he points out that buttermilk, yoghurt and whey are borne better than milk. The care of the mouth is also an important factor. Food should be soft, and mushy, and when meat is given it should be very finely chopped. Tapioca, rice, and meringues can be used to give variety to the diet. As beverages, he allows only tea when the motor power is insufficient and orange flower tea when it is normal, linden flower tea when there

¹ Correspondenz-Blatt f. schweizer Aerzte, Basel, September 9, vol. xlv, No. 37, p. 1121.

is gastrogenous diarrhea and yoghurt when there is constipation. These beverages are used once a day at afternoon tea.

Gastric Ulcer. ORIGIN OF GASTRIC ULCER. *The Trophic Element.* Durante¹ reviews the question of the origin of gastric ulcer, and believes that the sympathetic nervous system is largely responsible for this condition, inasmuch as it controls the vasomotor nerves to the stomach and is the trophic nerve as well. Durante performed experimental studies and used the lumbar route in his nerve resections. His results were as follows:

1. No lesion results after resection of the major splanchnic.
2. Resection or ligation of the median splanchnic invariably caused hemorrhagic and non-hemorrhagic lesions.
3. Resection of the minor splanchnic occasionally produced a slight hemorrhagic lesion.
4. Resection of the median and minor splanchnics caused lesions.
5. Resection of the three splanchnics produced lesions.
6. In resection or ligation of the median splanchnic, hemorrhage and intense congestion were seen in the adrenal of the corresponding side; but these changes did not occur alone when the major splanchnic alone was resected.

The hemorrhagic lesions appear to be due to a minute lesion in the bloodvessel of the muscularis mucosæ. The hemorrhagic area is conical, its base coincident with the surface of the mucous membrane. The non-hemorrhagic areas are small, conical, pale, and few in number. These mark the first stages of a specific kind of ulcer which presents the characteristic features of true chronicity. Disturbed enervation will suffice to present lesions, both acute and chronic, comparable to those in man. Overstimulation, rather than insufficient innervation, seems to be the cause of hemorrhagic gastric ulcer. The non-hemorrhagic lesion is due to a spastic disturbance due to the action of the adrenal. This action produces rupture of the bloodvessels at some points and spastic contraction at others. Ulcer may be produced by any agent capable of damaging the sympathetic nervous system, as it is on the integrity of this system, which controls the circulation, secretion, and profound sensibility of the stomach, that the very life of the gastric cell may be said to depend.

DIAGNOSIS. Dahl² discusses the question of the diagnosis of ulcer in 41 cases which he had observed and operated on. In 19 of these cases, there had been no bleeding except occult in 2, but all suffered from pain coming on two to four hours after eating, except 4 who suffered pain one or two hours after eating. In none of them did the pain come on earlier than one hour. The pain always came on at the same point, but it came in the shortest time interval after a small meal and after the longest time with a large meal. In quite a few cases there was no painful point. In a number, there was tenderness only during the painful intervals. There was hypersecretion in only 8 cases, and no

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 399.

² Hygiea, Stockholm, vol. lxxviii, No. 18, p. 1408; abs., Journal of the American Medical Association.

vomiting in 23 of the 41 cases. Vomiting occurring at the height of the pain is characteristic, but rare. The röntgen findings were not decisive in 4 cases examined with the screen. In short, according to this author, the pain is the only reliable point in the diagnosis of gastric or duodenal ulcer. The patients were from eighteen to sixty years of age and the duration of the ulcer symptoms dated from one to thirty-seven years before.

TREATMENT OF GASTRIC ULCER. One of the most interesting communications in this line has been that of Smithies.¹ Smithies discusses the etiology of the ulcer, summing up the problem of therapy from clinical, experimental, histopathological, and physiological grounds. A resumé of this paper is well worthy of careful consideration, and I have gone over these studies rather fully because I feel that many of his deductions are fully justified by modern research.

The problem: 1. *Clinical.* Gastric ulcer is a disease which may be so mimicked by non-ulcerous conditions of the stomach and upper abdomen that at times its determination becomes a matter of difficulty. That it can be essentially latent we all know, and that it exhibits a periodicity in about "84 per cent." of cases is a fact to which every clinician will attest. Acuteness of symptoms does not necessarily indicate the nature of the ulcer, inasmuch as acute manifestations, histologically, may become engrafted on an old ulcer. Smithies says, "peptic ulcer is an ailment entirely indistinguishable from the early appearance of gastric cancer, syphilis, or tuberculosis;" and equally important this fact, "that it is a disease which but rarely occurs in individuals not already affected with other clinical abnormalities—infections of the head, throat, and neck; abdominal disease, *i. e.*, inflammatory changes in the appendix, gall-bladder perigastric lymph nodes, pelvic structures, etc.; disturbances in the eliminative, nervous, and lymphatic systems; and malfunctions in that group of glands concerned with food digestion and assimilation." A statement which, to our way of thinking, is entirely justifiable and in a sense forms the basis of the argument that ulcer is "a systemic disease."

2. *Experimentation.* The interesting and important fact regarding this phase of the study of ulcer is that many methods markedly different in their effects have succeeded in producing ulcer. The methods used in experimentally producing ulcer are legion, and need merely be enumerated: Bacteria, bacterial toxins, cutaneous burns, poisons of metabolic origin, extrinsic poisons, and poisons introduced into the stomach, alterations in the circulation of the stomach, artificial stenoses of the pylorus, and mechanical trauma. This does not complete the list, but in most instances the lesions produced are similar, and simply emphasize the fact that many methods may accomplish the same end. Smithies states that this summary indicates that we cannot expect to establish a single definite cause for ulcer formation. Most of these workers have insisted on isolated causes for ulcer formation: Rosenow, the streptococcus; Bolton, the action of gastrototoxic sera and the alteration of body sera in such a way that localized cell necrosis and

¹ American Journal of the Medical Sciences, 1917, vol. clxiii, p. 547.

digestion occurs; Türek, the action of the colon bacillus, while in the experiments already mentioned we found that both bacterial and non-bacterial toxins were capable of producing ulcer. It would therefore appear that we have no basis for regarding ulcer as a distinct disease entity.

3. *Histopathological.* There is no relationship between the histopathology of ulcer and its symptoms in most instances. Chronicity, in the histopathological sense, by no means indicates that a peptic ulcer is old in months or years. Malignant degeneration may occur quickly and in no way point to the existence of a previously benign affection. It would also be of significance to recall that the majority of peptic ulcers occur in that part of the stomach in which the greatest circulatory, muscular, and nervous activity is manifest.

4. *Physiological.* (a) *Chemical:* It is a striking thing that the corrosive action of the gastric juice has been assumed as responsible for ulcer formation and usually this factor has played the leading role in treatment. In a recent study of 500 cases of peptic ulcer, Smithies found in but 40 per cent. a concentration above 0.3 per cent. free HCl. In 35 per cent. the acidity was well within the normal range, while in the remaining 25 per cent. the acidity was reduced or was entirely absent. [This is entirely in accord with our findings, and represents roughly the normal quota of hypersecretory, isosecretory and hyposecretory findings, achylia being a very rare finding in healthy individuals, although we have found such cases—namely, achylia without symptoms.—*Reviewer.*] Many points emphasize the secondary importance of acid in the primary formation of ulcer. That it plays an important part after the ulcer has become chronic, I think no one will doubt. (b) *Motor:* It would seem that the mechanical factors concerned with digestion are of greater importance than are variations in secretory function. This may be true regarding general digestive processes; it is hardly true regarding the ability of the stomach to resist infection. It is with the mechanical factors that Smithies proposes to deal in proposing a rational treatment of ulcer.

In order to emphasize these points, the following important facts must be borne in mind: The fasting stomach is in a state of tonic contraction. It is rarely empty. [Never so.—*Reviewer.*] It contains both hydrochloric acid and pepsin. These secretions apparently aid in preserving gastric tone, in digesting mucus, dead bacteria, and desquamated cell detritus. Hunger is manifested by rhythmic gastric systoles. These precede appetite desire, and cause an unpleasantness that leads to eating. Repeated swallowing motions cause an inhibition in gastric tonus. Eating starts gastric juice production. Food entering the stomach initiates peristaltic action peculiar to gastric digestion. These peristaltic movements continue so long as food remains in the stomach. They pass from the pars media toward the pylorus in rhythmic sequence in a given case with equal intensity, thus maintaining a constant pressure in the antrum. The proximal third of the stomach acts mainly as a sac or reservoir, and is comparatively free from peristaltic activity. The acid reaction of the contents of the fundus closes the cardia. The discharge of chyme from the stomach is intermittent. The pylorus opens only

when the gastric contents relax the sphincter. The presence of acid chyme in the duodenum closes the pylorus and keeps it closed until the duodenal juices have rendered its contents neutral or alkaline. The peristaltic waves press the acid chyme toward the pylorus and intimately mix the gastric contents and digest them. Only after the duodenal contents are neutralized can the pylorus relax and the acid chyme pass through. This alternate opening and shutting of the pylorus with the discharge of chyme is continued until the stomach is empty.

Water and normal salt solution cause limited gastric secretion and rapid stomach emptying. We have demonstrated that water is a definite gastric stimulant and on that basis the water meal of Austin is given. Carbohydrate foods leave the stomach quickly on account of their failure to unite with the acid gastric juice (also because they cause relatively less stimulation of the gastric secretion and no pancreatic regurgitation, or very little). Alkali delays the appearance of acid by temporarily checking the secretion of the acid gastric juice and also by uniting with the free acid already poured out. The acid control of the pylorus is thus interfered with and emptying delayed. Protein food leaves the stomach slowly because proteins join with the free HCl and thus for a time retard the development of the acid reaction which initiates pyloric opening. Protein has also been shown by Khingine to cause the secretion of 50 per cent. more gastric juice in the first four hours of digestion than when carbohydrate is fed. When such protein is passed into the duodenum there is more acid to neutralize than when carbohydrate is fed, consequently the pylorus remains closed a longer time and the antrum of the stomach is subjected to intense peristaltic activity without relaxation. [This is not exactly true inasmuch as some of the material is almost constantly passing the pylorus during even the delayed periods, tonic closure rarely occurs even with protein meals.—*Reviewer*.] It is estimated that in such an event, waves numbering from 300 to 500 an hour pass over the stomach. Cannon states that at the end of half an hour eight times as much carbohydrate as protein has been absorbed, and there exists twice as much carbohydrate as protein in the jejunum. Fats remain longest in the stomach because they excite little free HCl production and consequently the acid control of the pylorus is reduced to a minimum (?).

In the treatment of ulcer, Smithies believes in getting rid of all infections, and carries out the following method of medical treatment which I have given almost verbatim:

"1. *Rest in bed*, both physical and mental, for from one to three weeks. Bodily and psychic activity stimulate peristalsis.

"2. *Rest to the stomach itself*. When it is recalled that during an ordinary meal the digestive processes demand more than 2000 peristaltic waves, the effect of such as a mechanical irritant to an ulcer or the ulcer-bearing area cannot be disregarded. Complete rest for the stomach also demands avoidance of irritating medicine, gastric lavage, and frequent abdominal examination of the suspected focus.

"3. *Local applications to the abdomen*. Painful spasms are further prevented by having constantly applied to the abdomen compresses saturated with Ochsner's fluid (alcohol and boracic acid).

"4. *Keeping the stomach empty of food.* This promotes healing by limiting local irritation from the food itself, from reducing the amount of gastric juice required to digest food, by limiting gastric peristalsis and avoiding painful gastros spasms which limit free circulatory interchange. The abstinence from food by mouth should be insisted upon for from three to seven days, according to the case. The period of fast is determined best by clinical disappearance of gastric spasm (pain regurgitation, waterbrash, heartburn) and by fluoroscopic proof of absent or diminished gastric peristalsis. During the fast, paraffin wax is chewed for fifteen minutes every hour. It keeps the mouth clean, promotes free flow of protective saliva and mucus, counteracts painful hunger contractions and gastros spasms, and allays thirst.

"5. *Rectal feeding.* During the fasting period, rectal feedings are instituted. From 500 to 1000 calories of nutrient mixture are given in twenty-four hours. We use a clyster containing one ounce of 50 per cent. alcohol, one ounce of glucose with normal salt solution to make 240 c.c. The nutrient enema is given at body temperature by the drop method. The drops flow at the rate of 30 to 60 drops per minute. During the first day of rectal feeding, 10 drops of tincture of opium are given with each enema.

"6. *When mouth feeding is begun,* usually from the fourth to seventh day, two factors control the choice of diet: (a) nourishment should be liquid and administered warm in small quantities frequently, and (b) carbohydrates should be selected.

"(a) Small quantities of liquid food should be frequently administered in order that the stomach empties rapidly with the least effort and thus remain food-free for the longest time, thereby giving maximum time of rest for ulcer healing. The duodenal digestion must be called upon until gastric conditions warrant demands being made upon stomach digestion. Keeping the stomach food-free keeps hydrochloric acid or pepsin production to a minimum. From 4 to 6 ounces of warm liquid are given every hour.

"(b) As experimental facts have established, carbohydrate foods leave the stomach most quickly. Therefore, liquid carbohydrate mixtures (barley water, rice gruel, thin cream of wheat, thin creamed vegetable soup, etc.), are fed. Milk is not given as routine. Milk results in almost pure protein clots in the stomach. These act as do other proteins and remain for a long time in the stomach as a source of irritation, as stimuli to acid secretion and as choice culture media for bacteria. If milk be given at all, it should be first parboiled or predigested. Carbohydrate liquids produce the least secretion of HCl and pepsin, and are weak stimuli of gastric peristalsis and impose the minimum of work upon the duodenum. It should be recalled that the pylorus opens only when the duodenal contents are neutral or alkaline. If the gastric contents are of such nature as to impose slight demands upon the stomach secretions and motility, the duodenum has little work as a neutralizer to perform and the pylorus remains free from spasm and opens readily. There are thus avoided gastric stagnation and accumulation of distressing free and combined acids, which prevent

healing and which usually demand frequent lavage or the exhibition of large quantities of alkali.

"7. *Limitation of overproduction of gastric acid.* This is obtained by keeping the stomach food-free as above described. This secondarily limits both the frequency and the strength of gastric peristaltic waves. Unless food leaves the stomach rapidly, gastric glands continue secretion and coincidently stress of gastric peristalsis upon the pylorus keeps up constant irritation of ulcer-bearing areas. If the above points established by modern physiological research are borne in mind, the exhibition of large quantities of alkali are unnecessary. Their use is certainly unscientific. Providing the gastric lumen is patent, the stomach empties freely. There is no stagnant, irritating, fermenting residue. Large quantities of alkali, according to Pavlov and to our clinical and laboratory experience, create pernicious increases of gastric acid and of mucus, and generally demand relief by lavage. Moreover, we have shown that many gastric ulcer cases do not exhibit hyperacidity or hypersecretion. It is true that the stomach can neutralize large quantities of alkali if compelled to do so, but there is no physiological reason why it should be called upon to thus overwork. It will be remembered that the normal habitat of gastric epithelium is an acid, or, at the best, neutral medium. If these epithelial cells are called upon to live in an excess of alkali, they live, as it were, in the presence of a foreign body. Experiments in artificial tissue-growth have shown that cell proliferation is retarded by hyperisotonic alkaline solutions. Hence, overalkalinization may prevent healing. Attempts at protection from this foreign body (excess alkali) are shown (1) by the acid-producing glands oversecreting, and (2) by the mucoid degeneration of physiological fatigue which results in the throwing out over the secretory glands of a protective layer of mucus. The vicious circle thus formed results in enormous secretion of acid and mucus, and is doubtless at least a partial explanation of the so-called hypersecretion associated with gastric ulcers, particularly when such are treated by the overalkalinization method. To combat this condition of affairs, the patient's stomach must be washed frequently or greater quantities of alkali must be given in order to overpower the stomach's defensive mechanism and produce fatigue or exhaustion of the acid-secreting mechanism. It is a common observation that those patients who are treated for ulcer by the overalkalinization procedure always require frequent gastric lavage in order to ensure their comfort. This frequent lavage is to be condemned, not only on account of its disagreeable features, but because it acts contrary to the primary requirement of healing, namely, rest of the affected part. It is quite evident to those who have watched the behavior of a stomach, by means of fluoroscopic screen, when a tube is inserted into the stomach that gastric lavage defeats this primary principle of healing. Lavage is generally accompanied by vigorous gastric contractions that persist not only during the maneuver but often for a long time afterward. If dieting is arranged on the carbohydrate basis, alkali is given in only sufficient quantities to keep the stomach slightly acid or neutral and to neutralize the duodenum, thus aiding in pyloric relaxation, gastric lavage

need rarely be instituted during the entire course of a patient's treatment. In the past five years we have not employed lavage therapeutically in ulcer cases more than a dozen times. Lavage is so rare a procedure in my clinic that my associates and patients consider such an order as almost contra-indicated. It is readily judged how a treatment, of which lavage does not form a prominent feature, contributes much to a patient's peace of mind and shortens the period of hospital incarceration.

"8. *Medical treatment.* It is doubtful if any form of medicine has a direct healing effect upon peptic ulcer. Medicines are administered largely to counteract discomfort due to three main causes, namely, (a) painful gastrosplasm, (b) accumulations of overacid gastric contents associated with peristaltic unrest, (c) pain associated with perforation.

"(a) Painful gastrosplasms are usually controlled by carrying out the dietetic principles which I have above mentioned. The chewing of paraffin wax relaxes the pyloric spasm largely through stimulating a proper swallowing reflex and by fatigue of hunger-like contractions.

"Certain types of cases in which there is an individual vagus hypertonia, or when ulcers are located at or near the orifices, demand the exhibition of antispasmodic medicines, such as atropine, tincture of belladonna, or bromides. In the early stages of the treatment, atropine may be given hypodermically, or bromides may be placed in the nutrient enemata. Later, when food is being given by mouth, tincture of belladonna in doses of from 5 to 15 drops may be administered fifteen minutes before feeding from three to six times daily. We have not found useful, as analgesics, the exhibition of large doses of such "protective" medicines as bismuth and olive oil. These medicines doubtless act by affecting the rate and intensity of peristalsis, although they may have some effect in proved cases by direct action upon the ulcer. At times, orthoform, given in 10-grain doses in warm water, is an efficient local anesthetic when it is able to come in direct contact with an open ulcer.

"(b) For the relief of overacid gastric accumulations, sodium bicarbonate is contra-indicated, because its administration results in the production of annoying accumulations of carbon dioxide with resultant gastric retention or painful belching, and because its neutralizing value is comparatively low. Large quantities of bicarbonate of soda are necessary to give relief, and the administration of such secondarily produces excessive gastric secretion. If alkalis are indicated, better results are obtained by the exhibition of frequent small doses of milk of magnesia or calcined magnesia. The ordinary case is very comfortable when from 5 to 10 grains of calcined magnesia are given every two or three hours. Many cases require no exhibition of alkali if the physiological principles above outlined form the basis of the treatment. Only in very extreme cases is it necessary to employ gastric lavage. When it is employed, warm Carlsbad water (1 dram of artificial Carlsbad salt to 1 quart of water) may be satisfactorily administered. Usually the exhibition of atropine or belladonna for the relief of gastrosplasms exerts a definite effect toward controlling oversecretion of acid juice.

"(c) The acute prostrating pains of perforation are best controlled by prompt administration of morphin hypodermically, rest in bed, and hot

compresses to the abdomen. Only prompt surgery saves the patient's life.

"9. *Hemorrhage.* Constant seepage, demonstrated either microscopically or clinically, is generally an indication for abdominal section. Intermittent seepage may be controlled best by rest in bed, morphine hypodermically, intravenous injections of fresh horse serum, coagulose, or by copious transfusion of whole blood. In acute hemorrhage accompanied by vomiting, prompt lavage of the stomach with water at 110° F., frequently stops both the vomiting and the hemorrhage. The exhibition of morphine, rest in bed, whole blood transfusions generally prevent recurrence of hemorrhage. In this class of case, however, surgical intervention should be resorted to early, and this especially if, in a given patient, frequent, copious, prostrating hemorrhages occur.

"10. *Bowels.* During the early periods of treatment, simple soapsuds enemata may be administered every second day. After the second week, morning doses of sodium phosphate or Carlsbad salt in hot water may be given. In chronic cases, liquid paraffin, given in equal quantities of warm cream, results in easy motions, and the paraffin appears to have certain protective value upon the ulcer-bearing area."

Summary of Smithies Dietetic Regime in Treatment of Peptic Ulcer. Days one to seven. (Time varies as outlined in above description of treatment.)

By mouth. One-half ounce of warm water hourly when awake. Patient chews paraffin wax for fifteen minutes at least once in two hours. Juice of sweet orange or grapefruit occasionally. By rectum, nutrient enema consisting of 50 per cent. alcohol, 1 ounce; glucose syrup 1 ounce, and normal salt solution 6 ounces every four hours. The enemata are preceded by cleansing irrigation of the colon with normal salt solution. They are given at body temperature by the drop method at the rate of from 30 to 60 drops per minute. Calories daily approximately 1000. During the first two days, 10 minims of tincture of opium is added to each second enema.

Days three to fourteen (case of average severity).

By mouth. From 4 to 6 ounces of water gruel at temperature of 100° F. The gruel is taken slowly through a glass tube. Gruels are made from rice, cream of wheat, oatmeal, sago, cornmeal, malted milk, macaroni and vermicelli, rusks, potatoes, asparagus, cauliflower, beans, peas, and boiled onion. They are strained before feeding. Flavoring with coffee, chocolate, vanilla, caramel, etc., renders the cereal gruels palatable and their administration easier. Small quantities of arrow-root or cornstarch are added to the vegetable gruels to secure a thin emulsion.

Before each feeding, paraffin wax is chewed for five minutes. Warm water or sweet orange or grapefruit juice are allowed as desired, but never in greater quantity than 1 ounce at a time.

By rectum. During the first two days of mouth feeding, two alcohol glucose-saline nutrient enemata are given. During the second two days of mouth feeding, no rectal feedings are given in the average case. Calories approximately 800.

Days fourteen to twenty-one.

6.30 A.M. A glass of hot water and one teaspoonful of non-effervescent sodium phosphate.

7.30 A.M. One ounce of sweet orange or grapefruit juice, 2 ounces of thin cream of wheat, or farina, or well-cooked rice, or cornmeal, 2 ounces of skimmed, parboiled milk may be taken with cereal, and, if desired, a small quantity of powdered sugar used; one zweiback with a thin layer of fresh butter, 4 ounces of parboiled skimmed milk, containing half volume of lime water, served warm and flavored with coffee, cocoa, caramel, or vanilla.

9.30 A.M. Six ounces of thin water gruel, from cereals or fresh vegetables, strained and served hot, one rusk or zweiback, or dry toast.

11.30 A.M. Four ounces of malted milk, whipped egg, with parboiled milk cornstarch pudding, simple custard lightly cooked.

12.30 P.M. Six ounces potato, pea, bean, or asparagus purée (strained) or vegetable broth, 4 ounces of salisbury steak (moderately well cooked) to chew; 2 ounces (cooked weight) of thin rice, sago, tapioca, or cornstarch pudding made with parboiled milk and a small quantity of pulverized sugar may be eaten with the pudding; one rusk or zweiback, 6 ounces of parboiled milk and quarter volume of lime water flavored to taste.

4 P.M. Four ounces of water gruel from cereals, one very soft poached egg, one rusk or zweiback, 4 ounces of hot Vichy water.

6 P.M. Four ounces of whipped egg, two rusks or zweiback, 6 ounces of malted milk (thin) flavored to taste, or cereal water gruel or parboiled milk, and quarter volume of lime water gruel.

9 A.M. Six ounces of water cereal gruel or 4 ounces of malt marrow, two Graham crackers. Calories approximately 1500.

Days twenty-one to forty-two.

6.30 A.M. Two teaspoonfuls of phosphate of soda in a glass of hot water.

8. A.M. Juice of one sweet orange or half sweet grapefruit, or boiled prunes passed through a fine colander; 2 ounces (cooked weight) of thin cereals (cream of wheat, farina, oatmeal, cornmeal), 2 ounces of skimmed milk and small amount powdered sugar, 1 soft poached egg, 2 zweiback, 2 rusks or 2 thin slices of well-toasted Graham bread, 1 pint of hot skimmed milk and a quarter volume of lime water flavored to taste (cocoa, vanilla, etc.).

10 A.M. One pint of hot parboiled whole milk and fifth volume lime water, 2 rusks or Graham crackers.

12.30 P.M. Four ounces of creamed soup from vegetables strained, 6 ounces rare meat to chew, 4 ounces well-mashed potatoes or baked potatoes (mealy inside) or carrot, peas, beans, cauliflower, Brussels sprouts, or asparagus (all vegetables passed through a strainer and served with 15 grams of butter), 4 ounces (cooked weight) of pudding from rice, cornstarch, sago, tapioca, cream of wheat, or farina, or 4 ounces of custard, pulp of sweet orange, grapefruit, or prune whip, or chew 6 ounces of watermelon or cantaloupe, half-pint of hot skimmed milk.

3.30 P.M. One hundred and fifty c.c. of hot whole milk and quarter volume of lime water or 150 c.c. of malted milk or weak cocoa.

6.30 P.M. Two rusks or zweiback, or 2 slices of well-toasted Graham bread, 2 soft poached eggs, 100 grams of sweet apple sauce or 1 baked apple (omit skins) or juice of sweet orange, half of grapefruit, or chew 6 ounces of melon, 1 pint of skimmed milk, hot.

9 P.M. Two hundred and fifty c.c. of whole, parboiled milk and quarter volume of lime water or 250 c.c. of malted milk, hot. Calories for twenty-four hours approximately 2000.

General diet after three months. If distress, patient should go back to seven to twenty-one day diet.

7 A.M. One pint of skimmed milk and half-gill of cream.

9 A.M. Two pieces of toast without butter, juice of one sweet orange or grapefruit or ripe melon or apple sauce or baked apple (do not eat skin) or marmalade, 1 dish of well-cooked cereal (oatmeal, farina, or cream of wheat), 2 very soft poached eggs, 2 cups of hot, sweetened water. The water may be made more palatable by flavoring with cocoa, tea, coffee, or cream.

11 A.M. One cup of bouillon (two cubes), 2 Graham crackers.

1 P.M. This should be the heavy meal of the day. It may consist of meat (rare beef, rare hamburger steak, lamb, or white meat of fowl, fish, never fried), oysters, well-cooked spinach, cauliflower, carrots, squash, peas, hulled string beans, Brussels sprouts, baked or mashed potatoes (in moderation), rice with gravy, simple puddings made from cereals, cornstarch, gelatin, well-cooked fruit sauces, simple cakes, no white bread (all bread should be made from dark flour and should be at least one day old), 1 pint of skimmed milk taken hot.

4 P.M. One glass of hot peppermint water (20 drops of "essence" of peppermint to the glass), sweeten to taste and drink slowly; 2 Graham crackers.

6 P.M. A light lunch consisting of vegetable soup, simple salad, toast, soft eggs, and plain puddings or cake, with or without ripe, cooked fruit sauces, 1 pint of hot skimmed milk.

Bedtime. One glass of malt marrow, malted milk, or hot skimmed milk. Calories approximately 3500 for twenty-four hours.

SUGAR DIET IN GASTRIC ULCER. Loeper¹ recommends the use of sugar in the medical treatment of gastric ulcer, especially in that form with intractable vomiting in which nothing will be retained by the stomach. Milk is not well tolerated by many of these cases. The casein coagulates in coarse curds, the fat produces gastric stasis, and the milk readily ferments, producing lactic acid. The lactic-acid fermentation can be readily prevented by the use of alkalies and lime. Skimming off the cream reduces the fat and makes the milk more digestible, according to this author. The large size of the clots can be prevented by making the milk homogeneous by diluting it, and by adding substances like chloride of lime and rennet, which bring about fine coagulation of the albuminous mass. Mathieu recommends the use of diluted

¹ Jour. de méd. et de chir., June, 1916; abs., Practitioner, vol. xevii, p. 196.

citrated milk. One liter of this is composed of two-thirds, three-quarters, or four-fifths of milk, with water added to make that quantity, in which are dissolved 10 grams of citrate of soda. The amount of milk in the mixture is increased gradually, according to the tolerance shown by the patient. Small quantities, gradually increasing in amount, are given frequently.

In most cases this method is very effectual and gives rise to no pain. The sodium citrate not only arrests the gastric intolerance, but has as well a strong alkaline action, and very seldom causes milky urine like sodium bicarbonate. It is possible for the patient to take 1200 to 1500 c.c. of citrated milk.

There are, however, some patients who cannot take citrated milk. It may cause pain, constipation, acid eructations, or cause the patient to lose weight. Some substitute must be devised, and, for this purpose, Loeper recommends the sugar diet. First of all he includes syrups flavored in every possible way—gooseberry, pomegranate, cherry, raspberry; clear jellies or preserves, slightly acid, but not too much so, such as apples, gooseberries, quinces; barley-sugar and sweetmeats of gum; sorbets of all kinds, providing they contain no alcohol, lemonade, orangeade, and fresh grape juice.

As a rule, this diet is well tolerated and does not occasion gastric pains if the sugar is well diluted. It may cause fermentation, but, owing to very rapid absorption, this is not pronounced. The lack of mineral salts may be made up by the judicious administration of sodium phosphate and the phosphate and carbonate of lime. This diet is not given longer than five or six days, and simply represents an urgency ration which supplies the satisfying nutriment for the time being. As soon as the condition of the stomach permits, the sugar is replaced by light food, soups, bouillon, arrow-root, tapioca, then by purées of potatoes, lentils, and haricots, with well-baked biscuits.

Harris¹ modifies the Lenharz treatment, claiming for it simplification and greater accuracy. The nurse prepares a mixture of 1 egg, 1½ ounces of cream to 4 ounces of milk, and gives it every hour from 7 A.M. to 7 P.M., in gradually increasing doses, beginning with ½ ounce the first day and increasing ½ ounce every day. It requires six days to get up to 3-ounce feedings, and the quantity is kept at 3 ounces for four days. From the seventh to the tenth day a soft-cooked egg and 2 tablespoonfuls of strained oatmeal may be given with the feeding at 7 A.M. and at 7 P.M., and at 1 P.M. 2 tablespoonfuls of scraped meat, lightly broiled, and 2 tablespoonfuls of rice with butter. After ten days, until the fifteenth day, 3 ounces of the egg, milk, and cream mixture are given at 9 and 11 A.M. and 3 and 5 P.M., and 2 ounces of strained oatmeal with cream and sugar and 1 or 2 slices (thin) of toast and 2 soft eggs for breakfast at 7 A.M. and 7 P.M.; chopped or minced chicken or scraped beef, dry toast, rice and ice-cream or gelatin at 1 P.M. Butter is allowed after ten days. Beginning with the fifteenth day, and for two months, the patient should have small meals three times a day, with an egg and

¹ Southern Medical Journal, Birmingham, Alabama, November, vol. ix, No. 11, p. 960.

1 goblet of milk between meals and at bedtime. Harris says that this diet may be given forty-eight hours after a hemorrhage and in three or four days after gastro-enterostomy. In the meantime the patient should receive some nourishment by rectum.

Yarotzky¹ describes his treatment of gastric ulcer, which is exclusively dietetic. When the patient enters the hospital, even with hemorrhage, he gets the next morning 1 raw white of egg, without salt, and in the evening of the same day 20 grams of fresh butter, also without salt. Each succeeding day, the amount of the whites of eggs is increased by one, and that of the butter by 20 grams until 8 whites and 160 grams of butter are taken. The latter amount may be continued for one or two days and then mashed potatoes may be added, prepared with water and butter. Any oil of good quality may be given in place of butter. No water is allowed, as this increases the flow of gastric juice. Water may be given in the form of enemas if the thirst is excessive. Later on, weak, sweetened tea is allowed. Milk is not given for a long time, but vegetables and various gruels, with oil or butter, are well borne. This diet, according to Yarotzky, ensures the greatest rest to the stomach, relieves pain, the belching, burning, and inflation of the epigastric region, and causes a contraction of the cavity of the stomach. This helps to bring the edges of the ulcer together and promotes healing. The gastric acidity with this treatment is greatly reduced. It has also been found useful in poisoning with caustics and corrosives threatening perforation. It is likewise of value in cases of hyperacidity and hypersecretion when it is necessary to keep the stomach at rest.

Türk² describes a method for the treatment of gastric ulcer which is as follows: Rest in bed is required for the first two weeks and advised for the third. There is a preliminary period of three days' fasting, during which small amounts of water may be allowed. On the fourth day a single meal of about 800 c.c. of cornstarch gruel is allowed; following this the patient is given two meals a day, with gradually increasing amounts of rice, steamed vegetables, and hydrolyzed meat. Naturally, the diet must be adapted to each case and changed to suit the symptoms which may come out under treatment. When meat is allowed early in the second week, the extractives must first be removed by soaking the ground meat in cold water for twelve hours, then by pressing out the juice and discarding it. The indication for this removal of meat extractives is the gastric hyperchlorhydria, for it has been demonstrated that their presence has a definitely stimulating effect on the acid production. The meat pulp that remains is placed in boiling water and steamed for one or two hours until the connective tissue is hydrolyzed to gelatin, the larger part of extractives removed, and the stearin fat, so difficult of digestion, is driven off. This process leaves a meat residue of rich protein value (50 per cent.), very digestible, and of high acid-binding power; it is rapidly absorbed, leaving no protein

¹ Russkiy Vrach, Petrograd, vol. xv, No. 23, p. 529; also Journal of the American Medical Association.

² Medical Record, June 24, 1916.

residue to augment bacterial growth in the intestines. Vegetables, similarly, should be steamed for two or three hours, to render them demulcent to the stomach and lessen the tendency to intestinal fermentation. When so treated, vegetables do not lose their alkaline properties nor their caloric value as when boiled, and aside from their nutrient value act as a colloidal paste on the mucosa of the gastro-intestinal tract.

OUTLINE OF TREATMENT.

DIET.	TREATMENT.
First week:	
1st day } 2d day } Fasting; rest in bed. 3d day }	Aspiration of gastric fluid one hour each day; filter washed with NaHCO_3 . Alkaline powder $3\frac{1}{4}$ when required with water.
Analgesic emulsion before feeding.	
4th day { 1 meal 800 c.c. cornstarch 5th day { gruel to be sipped in one 6th day { hour after morning lavage.	Lavage with AgNO_3 , 1 to 10,000, left in one and one-half minutes; washed with green soap. Alternate days: colon stimulation with pneumatics.
7th day: Two meals of rice, steamed vegetables and mashed potatoes.	
Second week:	
Rest in bed; two meals a day of rice custard, mashed potatoes; vegetables steamed three hours under pressure, hydrolyzed to paste.	Aspiration every day; colon stimulation on alternate days; lavage with AgNO_3 , 1 to 2000 (500 c.c.) for one and one-half minutes. Alternate days; alkaline powder when required.
Meat (small amounts) chopped fine and extracted in cold water for twelve hours steamed to hydrolyze connective tissue and remove extractives, also to drive off stearin fat; minimum milk and eggs; sugar allowed; keep up calories.	
Third and fourth week:	
Rest, not necessarily in bed; increase food amounts gradually, still insisting on hydrolyzed meat and vegetables.	AgNO_3 lavage and colon stimulation only at intervals; vaccines of <i>B. coli</i> communis; autogenous, sensitized to patients' serum; start with 50,000,000, watch reaction; increase doses every six days.
Fifth week:	
Get out into the sun and open air; stimulate interest and appetite.	Iron and iodides if needed; gastric exercise by double-tube insufflation of hot, moist air with aromatics and hot-water intragastric bag 115° by 800 c.c.; thyroid gr. $\frac{1}{4}$ three times a day; pituitrin if indicated; colon stimulation twice a week.

Carbohydrate Restriction in the Medical Treatment of Ulcer. Stone,¹ in a further contribution on this subject, outlines the method of treatment adopted. Gastric hyperacidity, according to this author, exists (1) as a part of a syndrome associated with prolapsed viscera and the neurasthenic state; (2) the result of reflex disturbance from other abdominal organs; (3) as a result of faulty habits of mastication and the choice of appropriate food. We are then met with the statement, "Although

¹ Journal of the American Medical Association, September 30, 1916.

easy of diagnosis, the cause of the disturbance is not easy to fathom." This should not be difficult if the above conditions are responsible for the trouble. Prolapse of organs and the neurasthenic state are vague generalities which cannot be claimed, except remotely, as a cause of hyperacidity. [Furthermore, it seems to me that the first important point to be distinguished is the question as to what is hyperacidity, increase in acidity, or decrease in acid tolerance. Our studies on normal individuals have taught us how hopeless it is to attempt a treatment of hyperacidity when over 30 per cent. of normal individuals develop a secretion which is, according to titration figures, hyperacid. The actual incidence of high acid figures in the visceroptoses compared with a group of normal individuals reveals comparatively little divergence in the relative percentage of high acid findings.—*Reviewer.*] Stone says that if this visceroptotic habit is associated with faulty dietary, namely, carbohydrates, which favor bacterial decomposition and also spasm and motor insufficiency, the course of chronic ulcer is furthered. [Our findings, extending over every sort of foodstuff and the separate investigation of nearly all the foods in the stomach, indicate that Stone's ideas are incorrect. On the contrary, the quantity of the secretion and the evacuation time are markedly lessened with carbohydrates—decidedly less than with other foods, and the question of bacterial decomposition and putrefaction within the organ is a comparatively small affair when the short evacuation time of these foods is considered. Carbohydrate indigestion, with the exception of pronounced gastric stenoses, is essentially an intestinal affair and only reflexly affects the stomach.—*Reviewer.*] I have been very much interested in these results of Stone, and have tried the separate digestibility of the various foodstuffs, so that I feel, with Smithies and others, that the essential diet in ulcer is one which is rich in carbohydrates.

Stone says, "Clinically, the patients with hyperacidity, delayed motility and ulcer do better when their intake of carbohydrate foods is lessened. Deeks called attention to this in 1912. Although I cannot subscribe to all the restrictions imposed by him, I am convinced that excess of carbohydrates is a common dietetic error with such patients. I am also convinced that restriction generally to those articles of food which do not contain more than from 10 to 15 per cent. carbohydrates, with small additions of food which contain more than 20 per cent., such as bread and potato, together with sufficient alkali to limit the secretion of hydrochloric acid, has given better results than heretofore obtained. The following general diet list in hyperacidity I have found useful, articles from which may be omitted, if found necessary, in any given case."

Proteins and fats—soft-boiled or poached eggs, omelette, broiled or baked fish, bacon, chicken, oyster or clam broth, custard (use small amount of sugar), butter, milk and cream, cream cheese, olive oil, tea.

Five per cent. carbohydrates (fodder vegetables and fruits), asparagus, cauliflower, water cress, spinach, egg-plant, lettuce, beet, or dandelion, greens, string beans, olives, grapefruit pulp.

Ten per cent. carbohydrates (fodder vegetables, fruits, and nuts).

Onions (boiled), squashes, turnips, carrots, beets, lemon juice (one teaspoonful with 1 ounce olive oil twice daily as salad dressing), orange juice and pulp, peaches, watermelon, cantaloupe, or musk melon, hickory nuts, filberts.

Fifteen per cent. carbohydrates (fodder vegetables, fruits, and nuts). Green peas, parsnips, canned lima beans, baked apple (pulp), pears, pecans, almonds, English walnuts.

The patient may take daily in addition, one potato, three slices of toast, one portion (breakfast) cereal or rice, purée of pea, corn ("Kornlet"), or spinach.

Avoid excess sugar in above foods, candy, syrups, condiments, sauces, pickles, green corn, tomato, cornstarch, macaroni, spaghetti, bread, crackers, cocoa, chocolate, coffee, and vinegar.

In addition, the patient is requested to take one glass of milk between meals and at bedtime. After each meal and after each glass of milk between meals, a powder consisting of heavy magnesium oxide, sodium bicarbonate and bismuth subcarbonate, is to be taken in from one-half to one teaspoonful doses in one-third glass of water. If evidences of hypersecretion exist, the powder is given every two hours, regardless of the feedings, between 7 A.M. and 10 P.M. with an additional glass of milk, and a dose of the powder should the patient awake during the night. By this plan the details of which were more generally stated in the previously published article,¹ relief is soon obtained, the evidences of pyloric spasm and food retention are decreased and the pyrosis and hunger pain soon disappear, due to the lessened gastric secretion and hunger contractions. It is, of course, difficult to rid the stomach of the bacteria of organic acid fermentation. If the organic acids persist, as evidenced by flatulence and pyrosis, gastric lavage may be used once daily one hour before the principal meal. A liter of a solution of salicylic acid, 1 to 1000, is well adapted for this purpose.

Weiss,² in the discussion of gastric and duodenal ulcer, offers the following suggestions for treatment: The treatment of gastric ulcer is principally dietetic and hygienic. Postmortem examinations show that a large number of ulcers heal completely, but the process is slow and tedious, often requiring months, and, in severe cases, years. In the medical treatment the following are the important points:

1. Absolute rest in bed for three or four weeks.

2. A carefully and systematically regulated diet. Absolute functional rest of the stomach and upper bowel for a week or ten days, the patient being meanwhile nourished exclusively by rectal feeding, or, when the patients are fairly strong, I have found a complete fast for some days at first to be still more effective. Theoretically, it is better to give the stomach an entire rest, but practically this cannot be done. When stomach feeding is resumed, the diet should be limited for the first week to milk given in quantities of from 4 to 12 or even 16 ounces,

¹Stone, W. J.: The Carbohydrate Factor in the Causation and Treatment of Hyperacidity and Ulcer, *Journal of the American Medical Association*, January 29, 1916, p. 324.

²New York Medical Journal, December 16, 1916, p. 1195.

every two or three hours, with one-sixth part of lime water or Vichy water. Then, by the end of two weeks, it is safe to add to the daily ration one or two raw eggs, beaten thoroughly, instead of the alkaline water. Leube's ulcer diet is at the present time highly esteemed. Later, the blander preparations of beef, mutton, etc., in the form of finely chopped meat, rather than broths, may be substituted for part of the eggs, and prunes and vegetables may be added. Still later, mashed or baked white potatoes and the other digestible vegetables, better chopped at first, may be allowed. But all meats are very stimulating to the gastric glands, and the amount of such foods should be strictly limited.

No ulcer patient should ever be dismissed without an emphatic warning that he cannot afford to risk a relapse by again eating injudiciously, including pepper, mustard, and other condiments in his fare.

3. Medicinal measures are of little value. Bismuth and silver nitrate may be given. From ten days to two weeks bismuth subcarbonate may be given in doses of from 20 to 30 grains three or four times a day in an emulsion with water and milk. If pain should persist in spite of these measures, sufficient sodium bicarbonate should be given to neutralize the hyperacidity. Opiates should not be given, since they all stimulate the secretion of the hydrochloric acid and thus tend to aggravate peptic ulcer. Locally, either dry heat or hot poultices should be kept over the abdomen, except in hemorrhage, and then the patient should be quickly brought under the influence of morphine. This puts the part to rest. Ice may be applied to the epigastrium, and horse serum administered.

Practically all internists, and all except a few of the more radical surgeons, now concur that rest and dietetic treatment, with the help of bismuth and alkalies, as required, should certainly first be given a trial, in simple, uncomplicated ulcer.

There are many cases in which a cure is not possible, although they may have received the most careful dietetic, hygienic, and medicinal treatment, and whenever there is uncontrollable vomiting or hemorrhage, or evidences of perforation, stenosis, or obstruction from any cause, there should be an immediate resort to surgery.

PERFORATED GASTRIC ULCER. Sullivan,¹ in a contribution on perforated ulcer which is mainly surgical, discusses some of the diagnostic points of perforated gastric ulcer. He says, with reason, that the burden of diagnosis will fall on the general practitioner and it is the general practitioner who will have to be the diagnostician. I am sure that this is the experience of many men who do gastro-intestinal work exclusively, namely, that perforation usually occurs when the general practitioner is at hand, rather than the specialist. This is not an infringement of the ability of the practitioner, for whom I have the greatest respect. It simply attests to the fact that, after all, the destinies of many of these cases fall back on him. Concerning the etiology of perforation, apart

¹ Journal of the American Medical Association, 1917, vol. lxxvii, No. 5, p. 330.

from the etiology of the cause of the ulcer, muscular exertion, trauma, food and alcoholic indiscretions are given as the predominating causes. That an infective process is present will be shown by the fact that so frequently there is a two-cycle phenomena of pain. A premonitory pain of greater or less degree was present in 14 cases of this series which the author presents. The "big" pain has followed on an average eight hours afterward.

The chief symptoms which lead to a direct diagnosis in these cases are: (1) Pain, (2) tenderness, (3) vomiting, (4) rigidity, (5) history of previous ulcer symptoms, (6) anxiety and restlessness, (7) increasing pulse and rise in temperature.

Pain is sudden and violent. It is described as "sharp," "cutting," "burning," or "bursting and stabbing." The important characteristic is that it is unyielding. Its localization is mostly epigastric and supra-umbilical. Its quick radiation sometimes to the right iliac fossa suggests acute appendicitis; but careful inquiry as to the early localization leads one on the right track. Its radiation may be in any direction. The prominent factor is that the pain is excruciating and increasing in severity to such a degree that the patient is unwilling to submit to examination.

Tenderness is unmistakable. It is acute and easily elicited. When the case is seen early, a careful and gentle palpation will lead to marked tenderness over the site of perforation. There were 15 duodenal perforations, and in 12 of them the most tender area was in the right hypochondriac region. In 3 the right iliac fossa was made out as the most tender area; hence the improper clue to a correct diagnosis. Of the 5 gastric cases, the maximum tenderness was all epigastric, and in 1 of these it was to the left of the median line.

Vomiting occurs very early, either reflex or induced. It is a valuable symptom. Frequently it gives slight relief to the agony at first, but later on it only increased the pain. Vomiting, however, gives rise to no definite sign, inasmuch as it is seen in so many abdominal conditions. The author mentions Eliot who reports 2 cases in which there was no vomiting at all. In the author's series, however, vomiting occurred early and in every case. The character of the vomitus varied with the amount of food taken, as well as the site of the ulcer. In duodenal cases the vomiting was greater in amount than in gastric cases.

The second symptom of greatest value is the *rigidity* of the abdominal muscles. Its appearance is early, and its increase always proportionate with the length of time following the onset of symptoms. Deaver says, rightly, that there is no condition in the upper abdomen where rigidity is so early and marked as in perforated ulcer. The "board-like" type is the most significant guide, and the fact that it is continuous points to a progressive peritonitis, and hence is of great value as a diagnostic sign. Coupled with these symptoms one can usually elicit a history of previous ulceration.

"In a case of so grave nature, one might expect shock and its associated signs to be manifest. However, this was not found in our series. The patients, on the contrary, seemed to be in fairly good general

physical condition. In only one instance, and that one was seen late, was there any evidence of shock. Yet all these patients presented the aspect of anxiety and restlessness which signified that some great calamity had taken place within them. Their attitude was one of intense suffering. But the average pulse rate in this series was 90. The average temperature was 99.8° F. The average respiration was 34. I consider the increased respiratory rate as an objective sign of value, because of the attempt on the part of Nature to restrain the movements of the diaphragm and thus lessen the pain."

"Given a patient who is taken suddenly ill with an acute cutting or piercing epigastric pain which is continuously agonizing and accompanied by a marked rigidity of the abdominal muscles, particularly in the upper half, and from whom a previous history of indigestion is obtained, the most imperative indication is operation. Differential diagnosis may have scientific value, but the moral value is dependent on early operation. There is no excuse for delay in the presence of such symptoms. It is true that acute appendicitis, perforation of the gall-bladder, acute pancreatitis and acute intestinal obstruction may give rise to an almost identical picture."

Patry¹ discusses this same subject of perforated ulcer. He claims that the outcome depends rather on the physician who suspects perforation than on the surgeon who operates. He had 27 cases of perforation, and 1 case developed under his own eyes. He was impressed by the fact that the clinical picture differed from the text-book description. One of the points which impressed him most was the pronounced remission of symptoms after the first shock lasting from a few minutes to several hours. Then the pain becomes bearable, the patient is stronger and looks better and the pulse grows slower and stronger. This deceptive improvement may last for several hours. This is the time for operation, and the advantage lies in the fact that the surgeon can take advantage of the reflex by the contracted state of the pylorus from irritation which seldom lasts more than five hours. After that comes the phase of peritonitis. Perforation of duodenal and gastric ulcer, according to this author, presents a more sudden and dramatic picture than does appendicitis. The general condition is more serious, the pulse weaker and faster, and the respirations become shallow and rapid of the upper costal type, the patient trying to spare his abdomen as much as possible. The muscle is woody only above the umbilicus, as a rule, and the pains spread upward instead of downward as they do in appendicitis. There is seldom fever with perforation at first, while this symptom usually accompanies appendicitis. Patry denounces the teaching that the perforation may occur like a bolt of lightning and also the teaching that there is always an ulcer history preceding the attack. I have been impressed by this same finding and I have had cases where no such sudden onset was present.

The perforation occurs usually during the period of gastric digestion, very rarely on the fasting stomach. The perforation may be walled

¹ *Revue méd. de la Suisse romande*, Geneva, September, vol. xxxvi, No. 9, p. 574.

off and the peritonitis remain strictly localized, even spontaneously subsiding. [This is true of the type perforating into the liver or pancreas with thick adhesions and forming the characteristic Nischen symptom with the x-rays. These cases may reveal no period of perforation, perforation being preceded by a thick inflammatory wall.—*Reviewer.*]

The shock of perforation is due to the sudden irritation of the peritoneum with the gastric fluids. The syncope and changes in the pulse rate are due to reflexes from the peritoneum (?). During the first five hours, the ulcer is the main thing, the peritonitis can be disregarded as a rule. After the fifth hour, peritonitis must be combated and the ulcer left to be attended to later, perhaps in six weeks or in three months.

GASTRO-ENTEROSTOMY. Wilinsky and Crohn¹ discuss the question of the *physiology and pathology of the stomach after gastro-enterostomy*. Their studies are the most complete which have been performed so far and comprise fractional studies, kymographic studies of the tonal and hunger contraction, as well as fluoroscopic study of 37 cases of ulcer of the stomach and duodenum in which a posterior retrocolic gastro-jejunostomy had been made. In all these cases the ulcer-bearing area had been excluded by the string method or by pyloric plication; 37 cases have been examined to ascertain the functional activity of the stomach after gastro-jejunostomy as performed by competent surgeons employing a technic uniformly accepted today.

Eleven of these fall into group A. These have all been regarded as cured. Clinically, they have few trivial or no complaints. Chemical examinations demonstrate a mildly diminished motility after Ewald and Riegel test meals, with diminished acidity and a moderate, but distinct and persistent, hypersecretion. The fractional method of Rehfuess shows a nearly normal curve. Kymographic tracings show moderate diminution in the tone, but in about half of the cases a return to the normal occurs very soon. The röntgen rays fail to show a six-hour residue and the stoma functionates properly.

The next 14 cases fall into group B. These cases remain poorly nourished and complain of the following symptoms: Pain, vomiting, occasionally hematemesis, constipation, or rarely diarrhea. They are frequently depressed mentally. Chemically, definite delay in motility is shown, and hypersecretion is present. The stomata functionate poorly. The kymograph shows either a complete absence, or a marked diminution, of the peristolic tone, and the normal hunger contractions are not regained. The radiograph shows the stoma to be functioning improperly, and the peristalsis is noted as active or very active. This group is characterized mainly by disturbed muscular function leading to inefficiency of a still patent stoma, with definite delay in gastric motility.

The third group comprises 7 cases of organic stenosis of the stoma. Clinically, they resemble the preceding group. Chemically, they show even a greater degree of gastric retention and delayed motility. By the kymograph they may be shown to have regained fair, or good, peris-

¹ American Journal of the Medical Sciences, 1917, vol. clin, p. 808.

taltic tone. Radiographically, they show violent peristalsis, six-hour residues, and inefficient, or closed, stomata.

It becomes evident, therefore, that the primary function, that of causing more rapid evacuation, is not achieved in gastro-enterostomy; furthermore, there is often a profound disturbance in function, as shown in the delay, and even absence, of the tonal and hunger waves, indicating intact peristaltic function. The statement that gastrojejunostomy is an operation which in no way impairs function is an erroneous one. Some time ago, at the Surgical Congress, I mentioned the same fact, and these results of Wilensky and Crohn I can confirm from purely secretory and motor findings. We have found, with undue frequency, motor delay and hypersecretion after gastro-enterostomy. It has always been my belief that gastro-enterostomy is an unphysiological operation to be recommended solely in those cases in which the stomach, owing to definite obstruction, is prepared for a new stoma. Much remains to be said about the conduct of the duodenal and pancreatic mechanism.

Tandberg¹ discusses the *complication* which beset 2 of his 50 *gastro-enterostomy* cases of ulcer. His method of relief is worthy of mention, even though the cause is not clear. These patients, after a posterior gastro-enterostomy, both developed occlusion of the duodenum on the eighth or ninth day. In 1 case the occlusion was corrected by a subsequent operation; in the other, further complications constantly developed, compelling five supplementary operations. No permanent relief was obtained until the pylorus and jejunum were resected, and Roux's technic was applied ten months after the first laparotomy. Great relief was obtained by introducing a T-drain, one end in the stomach, the other in the efferent loop, and the stem emerging from the abdominal wall. There was no nausea and vomiting when this drain was in place, but they returned each time when it was removed. With the T, it was possible to supply adequate fluids and food, and thus build up the patient's strength sufficiently to stand final resection.

Jacobson and Murphy,² in discussing the question of gastro-enterostomy, say that gastro-enterostomy is essentially a drainage operation and insist upon the fact that the stoma must be made as near the pylorus as possible. They emphasize the fact that, when possible, the stoma should be made in the antrum. If this dictum were universally carried out, there would unquestionably be fewer disturbances. We are not inclined to agree with this statement, however, that gastro-enterostomy openings, properly made and placed, functionate equally well in the presence of an open or closed pylorus.

Hypertrophic Pyloric Stenosis in Infants. Holb³ discusses the question of pyloric stenosis in infants. He claims that hypertrophy is nearly always the preponderating lesion and spasm is usually secondary. He points out that the symptoms begin usually in the third and fourth week of life, and are ushered in by forceful, projectile vomiting shortly

¹ Norsk Magazin for Lægevidenskaben, Christiania, March, 1917, vol. lxxviii, No. 3, p. 325; abs., Journal of the American Medical Association.

² Journal of the American Medical Association, 1916, vol. lxxvii, No. 18, p. 1324.

³ Ibid., March 26, 1917, vol. lxxviii, No. 21.

after feeding, often while the child is at breast. Visible gastric peristalsis he considers a constant symptom, while palpable tumor, consisting of a small movable mass about 2 x 3 cm., is to be found in the majority of cases. By means of a small rubber catheter and a syringe, he determines gastric motility two, three or four hours after a test meal, which usually consists of 2 or 3 ounces of breast milk. He considers this test quite as reliable as the röntgen rays for detecting retention. Coupled with these symptoms are to be found scanty urine, constipation, etc.

The most valuable part of the paper is devoted to *treatment*. He discusses the medical *versus* surgical cure, and points out the great improvement in results following improved methods.

Gastric Carcinoma. **DIAGNOSIS.** In discussing the röntgen interpretation of gastric carcinoma and ulcer, MacCarty¹ says that there are certain pathological reasons for a legitimate error in the röntgen diagnosis of ulcer and cancer of the stomach. In the first place there is no macroscopic differentiating structural difference between a single chronic gastric ulcer and an early carcinomatous gastric ulcer. There is no differentiating variation in muscular structure which might be the basis of diagnostic difference in gastric rhythm in simple chronic ulcer and early carcinomatous chronic ulcer. The diagnosis of early carcinoma in the border of a chronic gastric ulcer is the question of the position of a few undifferentiated epithelial cells in the mucosa or submucosa, and it still remains an open question whether or not röntgen rays can differentiate such small quantities of such cells from normally differentiated epithelial cells or the cells of other tissues in chronic ulcer.

Occult Blood in Differentiation of Gastric Carcinoma. Gregersen² concludes the result of an extensive research regarding the significance of occult bleeding. He regards the slide method of Wagner (benzidine) as absolutely reliable and to be recommended. With cancer, occult bleeding keeps up continuously week in and week out, while in the case of ulcer a series of negative-responses intermits a series of positive reactions. We can depend on negative reactions with chronic gastritis with achylia, colitis, simple dyspepsia with constipation, and gall-bladder trouble. His findings were constantly negative on 602 tests on 66 patients in this class, and they were likewise negative in 200 tests on 25 patients with heart disease, edema, ascites, nephritis, and cirrhosis of the liver. Of 34 patients with ulcer, the reaction was positive in 30; 26 were under observation for a long time, and, in every instance, the occult bleeding stopped for longer or shorter periods, or even permanently. In 13 patients with gastric carcinoma under observation through long intervals, examination of the stools never failed to give a positive reaction. When such tests gave a positive reaction for a few days and then a negative reaction, carcinoma could, according to the author, be excluded with certainty. The author believes that con-

¹ Journal of the American Medical Association, 1916, vol. lxvii, p. 1470.

² Ugeskrift f. Læger, Copenhagen, vol. lxxviii, No. 30, p. 1260; abst., Journal of the American Medical Association, 1916, vol. lxvii, p. 914.

tinued study for occult blood is of great value in the differential diagnosis between ulcer and cancer.

Polypus Carcinoma of the Stomach. Oettinger and Marie¹ describe an unusual form of gastric carcinoma in which a large pedunculated carcinoma weighing 134 grams in two lobes and free from ulceration was removed from the stomach. Intra-gastric examination revealed blood and apepsia, while the constant positive occult blood reaction in the stools spoke for carcinoma. The only symptoms were hemorrhages, each preceded by vertigo, buzzing in the ears and loss of consciousness. Curiously enough, we are told that palpation, and also röntgenoscopy were negative.

Occult Bleeding in Gastric Ulcer and Gastric Carcinoma. Boas,² who is responsible for the occult blood reaction, comes to practically the same conclusions as Gregersen, namely, that there is a difference in the manner of occurrence, as well as the form, of occult bleeding seen in gastric ulcer and cancer. In the case of carcinoma, the bleeding is persistent, while in ulcer there is a relatively quick disappearance of the blood. There is also a difference in the intensity of bleeding in the two instances. From this stand-point, therefore, Boas advances the belief that to make a satisfactory diagnosis, the feces alone must not merely be examined, but the stomach contents as well. By this procedure, it is possible to reduce the number of unnecessary operations now made in the case of unhealed ulcers which are not recognized as such, and to have such operations reduced as much as possible.

Value of the Dissolved Albumen Test. Friedenwald and Kieffer³ discuss the results of the Wolff-Junghans reaction in 173 cases. The reaction was only considered positive when it was still present at a dilution of $\frac{1}{200}$ to $\frac{1}{400}$ and was considered suspicious in dilution of $\frac{1}{100}$.

In the 173 cases, 106 were those of carcinoma, and 67 benign achylia, the results may be tabulated as follows:

67 cases of benign achylia—

9, or 13.5 per cent., gave positive or suspicious reactions.

58, or 86.5 per cent., gave negative reactions.

106 cases of undoubted carcinoma—

89, or 83.9 per cent. gave positive or suspicious reactions.

11, or 16.1 per cent., gave negative reactions.

The test is of little or no value in the presence of free HCl in the gastric contents, while those which contained acid or blood were discarded.

Of the 106 cases of gastric carcinoma, 89, or 83.9 per cent., gave positive reactions. In all of these cases, free HCl was absent, and lactic acid was present in 70, or 78.6 per cent., Oppler-Boas in 68, or 76.4 per cent., occult blood in the stools in 78, or 87.6 per cent., dilated stomach with retention in 38, or 52.6 per cent.

The test was made in 6 cases of carcinoma in other abdominal organs in which the stomach was not involved. Of these, the pancreas was

¹ Arch. des mal. de l'App. Dig., vol. ix, No. 1, p. 18.

² Arch. f. Verdauungskr., 1916, vol. xxii, Nos. 2 and 3.

³ American Journal of the Medical Sciences, 1916, vol. clii, p. 321.

involved three times, the bowel twice, and the liver once. All of these presented an absence of gastric acid, and, of these, 3, or 50 per cent., gave negative findings; 2, or 33 per cent., suspicious; and 1, or 17 per cent., positive.

An examination of 8 cases of peptic ulcer was made as to the amount of dissolved albumen. In all these there was an absence of free HCl. In 2, or 25 per cent., the reaction was positive; in 1, or 12 per cent., suspicious; in 5, or 62 per cent., it was negative. In 2 positive cases pyloric stenosis with dilatation was present. In 14 cases of chronic gastritis, it was positive in 1 case, or 7 per cent.; suspicious in 1 case, or 7 per cent.; negative in 12, or 85 per cent. In 45 cases of simple achylia, the reaction was present in 2, or 4 per cent.; suspicious in 2, or 4 per cent.; negative in 41, or 91 per cent.

Five cases of gastric carcinoma were studied according to the Rehfuess fractional method, and with this were compared the results obtained on 5 cases of simple achylia. [The conclusions were practically the same which we had reached, namely, that in the simple achylia, such as Clark and the reviewer pointed out, there is a small amount of dissolved albumen, producing a curve which runs more or less parallel to the acid curve, while, on the other hand, in carcinoma the protein curve diverges out of all proportion to the acid curve, considerable amounts of albumen being present as early as the three-quarter hour interval and usually increasing to marked positive reactions at the one hour and the one and one-half hour intervals.—*Reviewer*.]

The test is positive in at least 83 per cent. of gastric carcinoma [in still higher percentage when the entire curve is worked out—*Reviewer*], it occurs almost as frequently as the absence of HCl; it is more frequent than the presence of lactic acid or the Oppler-Boas bacillus and is of the greatest value in the differentiation between malignant and benign achylia.

Baetjer and Freidenwald¹ discuss the *x-ray diagnosis of gastric carcinoma*. From the fact that the normal stomach varies in size, shape, position, and even in its actual evacuation time, none of these factors can be taken as a guide for the diagnosis of carcinoma. The diagnosis depends rather on changes in peristalsis and filling defects.

In cancer of the cardia, there is a filling defect; in lesions of the body, a persistent defect at which point peristalsis is interfered with, due to gastric induration at that point. Both the annular and invasive type of pyloric carcinoma produce filling defects, the former producing early obstruction, the latter producing a persistent defect at, or close to, the pylorus which is free from peristaltic waves. It may exist free from obstruction. Spasm of the stomach may likewise produce filling defects which are relieved by two days' administration of full doses of atropine.

In the differential diagnosis between benign ulceration and carcinoma, the following points are of value:

1. In cancer, unless the pylorus is involved, there is hyperperistalsis and rapid emptying. In ulcer, there is hyperperistalsis, with pylorospasm and slow emptying.

¹ Bulletin of Johns Hopkins Hospital, 1916, vol. xxvii, p. 221.

2. Cancer may occur in any portion of the stomach wall; ulcer usually occurs on the lesser curvature near the pylorus.

3. In cancer, the lesion is surrounded by a large invaded area which is free from peristalsis. In ulcer this invaded area is much smaller or absent.

ETIOLOGICAL RELATIONSHIP BETWEEN GASTRIC ULCER AND CARCINOMA. Smithies¹ again discusses this subject and uses as the basis of his paper an analysis of 921 cases of gastric cancer and 500 cases of gastric ulcer. Of the gastric cancer cases, 65 per cent. were preceded by a history apparently of the benign dyspeptic type as seen in ulcer. He quotes MacCarty's account of the removal of 280 gastric ulcers, in which, clinically, there was no evidence of malignancy, but in which there was a typical cell formation in 63 per cent. The duodenum seems to have some inherent protective mechanism and cancer of the stomach rarely ever extends over into the duodenum. Most of the evidence of the malignant transformation of ulcer is to be found on the pathological side, sections through excised ulcers demonstrating all degrees of hyperplasia.

Smithies divides his cancer cases into two groups: (1) Those in which there was chronic dyspeptic disturbance, clinically benign, followed by an ailment which appeared clinically malignant from its start; (2) cases in which the disease was continuous and progressively downward, clinically malignant, with no previous gastric trouble. The first group shows the possibility of separating clinically the benign from the malignant. The proportion was 56.4 per cent. in group 1; 39.1 per cent. in group 2. Cases in group 2 were clinically malignant from the start, the average duration of symptoms being 7.6 months. The location in the stomach of cancers and ulcers practically identical is quite suggestive of relationship in origin.

OPERATIVE STATISTICS. Miyake² gives the details of 175 patients with gastric cancer who were submitted to operation between 1902 and 1914. During this period, 411 operations were performed. The entire article is based on 443 cases, in 32 of which no operation was attempted. In 28 of these cases, other members of the family had gastric cancer. In only 7 cases was there a reliable history of preëxisting ulcer. Of the 175 patients submitted to resection, 58 succumbed to the effects of the operation, a mortality of 33.1 per cent. He cites figures from 28 different clinics, regarding 1266 resections for gastric cancer, with a mortality range from 66.6 to 8 per cent., the average being 32.8 per cent. The technic is discussed in detail, as well as the present condition of the 117 surviving patients. Fifty succumbed to recurrence after intervals of a few months to five years, the average survival being nearly nineteen months. Nearly 15 per cent. are in good health up to date, more than three years after resection. Analysis indicates that the histological nature of the growth is not of such importance as the presence or absence of glandular metastases and tough adhesions. Exploratory laparotomy, according to this author, seems to be the only certain means for early diagnosis.

¹ *Lancet-Clin.*, 1916, vol. cxv, p. 203.

² *Journal of the American Medical Association*, 1916, vol. lxxvii, No. 20, p. 1480.

Gastric Syphilis. Eusterman,¹ in discussing this subject, comes to the following conclusions:

1. Syphilis of the stomach, though rare, is not as infrequent as generally supposed. The aid of the Wassermann-Noguchi reaction and röntgen rays are necessary to establish the presence and specificity of the lesion.

2. Denial of the disease, lack of evidence pointing to a primary lesion, or absence of positive Wassermann reaction, does not exclude the possibility of gastric syphilis.

3. The diagnosis is based on a history of infection, a consistently positive Wassermann reaction, indisputable evidence of a gross gastric lesion, and, excluding cases of irreparably extensive disease, a permanent cure by purely antisypilitic remedies. The diagnosis is often accidental. The possibility of syphilis should be considered in every typical case, or in those not responding to the ordinary methods of medical management.

4. The symptomatology of gastric syphilis, in view of the cases reported herewith, is suggestive of benign gastric ulcer; the gastric chemistry and röntgen findings rather suggest carcinoma. The average age of patients with acquired syphilis of the stomach is about thirty-five; the duration of the complaint averages three years. In most instances the condition is characterized by an initial intermittent course followed soon by continuous symptoms associated with epigastric pain of variable degree, felt shortly after taking food and not relieved by food or alkalis. From the onset there is a tendency toward emesis, a variable degree of flatulency, a good appetite, infrequency of hemorrhage and palpable tumor, diffuse abdominal resistance, a progressive course, and marked loss in weight without cachexia.

5. Anacidity or achylia is characteristic of the majority, if not all, cases of actual gastric syphilis. This can be explained by the influence of the pathological process upon the gastric mucous membrane.

6. Extensive gastric involvement is frequently present at the time when gastric disturbance first becomes manifest.

7. A gummatous ulcer, usually multiple, and especially a diffuse syphilitic infiltration with variable degree of contracture (fibrous hyperplasia), thickening, deformity, and perigastric adhesions chiefly involving the pyloric segment, is the usual pathological condition. Demonstration of the presence of the *Spirocheta pallida* in the resected tissue would be the final proof of specificity.

8. Results from antispecific treatment are encouraging in all but very advanced cases. Surgical interference is indicated in certain cases. Early diagnosis and intensive treatment invariably results in symptomatic cure and structural improvement.

STATISTICS of 23 cases.

Course. Nine cases continuous; 2 cases abruptly with pain and vomiting; 4 cases intermittent. Intermittent, remittent, or irregular in the rest.

Distinctly progressive in 2 cases (90 per cent.).

¹ American Journal of the Medical Sciences, 1917, vol. cliii, pp. 21-39.

Pain. In 9, this occurred as distress; in 6 it was cramp-like and severe, in the remainder, dull and gnawing; in three-fourths of the cases the pain occurred immediately after eating, and was of variable duration.

Nausea was definitely present in only 3 instances.

Vomiting was the second most important symptom in 19 cases (83 per cent.) and in 10 from the outset.

Hematemesis and *melenas* recorded in only 1 instance.

Flatulency was definite in 65 per cent., usually one hour after taking food.

Bowel function: There was marked constipation in 50 per cent., moderate to alternating with constipation in the remainder.

Appetite: Good in 60 per cent., abnormal, owing to starvation, in 10 per cent., complete anorexia or "poor" in 15 per cent.

State of nutrition: All cases showed a marked loss in weight, over 50 per cent. lost between 50 and 75 pounds.

Abdominal Examination. Definite tumor or mass absent in 20 cases (90 per cent.), present in 1 instance (4 per cent.); in 2 cases (9 per cent.) suggestion of "ridge feel," and, in all, muscle resistance with marked or moderate tenderness.

Gastric Analysis. Achylia in 18, or 82 per cent., 4 had an average of 22 per cent. free HCl (?). The average total acidity was 36 per cent. (?). In cases in which achlorhydria alternated with a low hydrochloric acid content, hypersecretion was not noted even in retention cases, which numbered 6 (26 per cent.). Blood was present in the gastric extract in 25 per cent., and occult blood was present in the feces in 17 per cent. of those examined. Lactic acid and sarcinae were noted in 2 of the retention cases; in 1 of these the Oppler-Boas bacilli were demonstrated. A consistent achlorhydria seems to be characteristic of gastric syphilis, at least in its advanced stages.

The reviewer has likewise encountered this finding not infrequently, but the general picture of pus and blood characteristic of many cases of gastric carcinoma is lacking. In both, however, there is the absence of hypersecretion. Whether this is due to inhibition of gastric function, atrophy of the gastric mucous membrane, or an induced gastritis granularis, such as is mentioned by the author, cannot be ascertained until we know just how far lesions, although diffuse, can affect the gastric secretion as the result of a general infection. An atrophic mucosa was found in their section. Eustermann mentioned the statement of Neugebauer who studied the gastric contents of 200 syphilitic recruits; 62 per cent. of them were in the second stage, and all showed subacidity. Brusch and Schneider reviewed the gastric chemistry of 100 tertiary syphilitics, and concluded that the frequency of achylia in that disease is due to "chronic gastritis." Clark¹ emphasizes the importance of gastric achylia and the absence of free hydrochloric acid. It may be well to mention at this point that the reviewer has seen even marked gastric retention disappear under intensive specific treatment.

¹ Brazil-medico, 1916, vol. xxx, 89-96; Abst. Journal American Medical Association, 1916, vol. lxxi, p. 1665.

Syphilis as a probable factor in vague gastric disorders is discussed by Lull.¹ He emphasizes the importance of realizing that syphilis can give rise not merely to organic syphilitic disturbances of the stomach, but that it is capable of inducing functional disturbances as well. The literature on syphilis is rapidly growing, and not a small part is the American contribution on this subject. Smithies, in recent reports, contributes 26 cases; Eusterman, 21 cases; Downes and Le Wald, 8 cases; Morgan, 7 cases, all based on clinical, x-ray, and serological studies, and I am sure that all of us can add to that number. The requirements laid down by Chase, namely, a positive Wassermann, evidence of syphilis elsewhere in the body, demonstration in the stomach of lesions by the x-rays, and, finally, therapeutic improvement, furnish the keynote in successful diagnosis.

In the light of newer pathology, according to Lull, syphilis may be said to affect the stomach in some one or all of the following ways: (1) By producing gumma, erosion, or endarteritis in the organ itself, (2) by causing demonstrable structural changes in other organs closely situated anatomically or allied in function to the stomach; (3) by producing changes not recognizable histologically, but due to spirochetal action direct, or through the agency of its toxins on the stomach itself, on the general nervous system, or on the blood.

It is this third group which we are essentially interested in, and it is this third group, showing no gross changes in the organs, which produces manifestations of such mild and varied character that the gastric symptoms are often masked by those of general nervous instability.

Lyon² gives a resumé of DIAGNOSIS AND TREATMENT of gastric syphilis. In view of the communications of Smithies, Eusterman, La Wald, Lull, etc., it is not necessary to review these in detail. The author calls attention to the subacidity or anacidity seen in this condition, but mentions the fact that several cases with normal acidity have been reported. I am sure that all of us have had our attention forcibly brought to the question of gastric syphilis and either through the history, or some suggestive objective findings, or a positive Wassermann reaction, have been led on the right track. Only recently I saw a series of these cases, one of pronounced obstructive phenomena which I diagnosed pyloric ulcer with stenosis and the x-rays corroborated the findings. Her gastric history dated back ten years and yet under intensive iodide and mercury administration all gastric, as well as obstructive, phenomena disappeared. In my experience the most common gastric finding in gastric syphilis which is anatomically deforming is anacidity or even achylia.

Lyon emphasizes the important points in the treatment of gastric syphilis and draws attention to several points which ought to be borne in mind, for instance: "In some cases spirochetes are locked up in the heart of pathological syphilitic lesions and on account of the devascularity attendant upon the endarteritis, the syphilitic antibodies may not have access to the circulating blood stream. In such cases the Wasser-

¹ Journal of the American Medical Association, 1916, vol. Ixvii, No. 14, p. 998.

² Archives of Diagnosis, April, 1917, p. 169.

mann reaction may be negative, until a provocative intravenous injection of neosalvarsan has been given, or may be weakly positive to begin with, with a general increasing positivity under treatment, until a definite point of pathological cure has been reached, when the serological reaction will progressively diminish in intensity."

SYPHILIS OF THE STOMACH PRODUCING HOUR-GLASS CONTRACTION. Culler¹ describes a very interesting case of hour-glass contraction of the stomach of syphilitic origin. After the nature of the condition became clear, he was given neosalvarsan, but paradoxically in this case the nearer the patient approached a cure of his specific trouble, the closer he came to death by starvation owing to the contraction incident to healing. An operation was finally necessary and a partial gastrectomy was performed. The contraction finally became so narrow that a grooved director would scarcely pass and showed a thin, glazed mucous membrane indicative of recent healing.

Gastropotosis. Bircher² contributes an interesting paper on gastropotosis and gastropexy. Gastric pains in ptosis are worse during the day and relieved by a reclining posture. The pain with ptosis is more to the left than that of ulcer, and, more important, is the fact that in ptosis it depends more on the quantity than the quality of the food. In the virginal type, as contrasted with the maternal type of ptosis, the tendency toward ptosis is aggravated by the pressure of the corset, and it is in these types that gastropexy works best. One important point which is brought out in this communication is the fact that ptosis cases are poor subjects for gastro-enterostomy. In one case in which he tried it and which eventually died, the stomach sagged down into the small pelvis, closing the gastro-enterostomy opening. He has applied gastropexy in 62 cases, and reports 67.7 per cent. cured, 20.9 per cent. improved, 9.6 per cent. failed to derive benefit, and 1.6 per cent. died. Roosing has a record of 163 personal cases, and has reported 93 by other Scandinavian surgeons, with a record of complete cure or improvement in all but 12 per cent.

Gastric Function in Pulmonary Tuberculosis. Mohler and Funk³ discuss the important question of gastric function in pulmonary tuberculosis. They studied, by means of the fractional method, 22 early and 25 advanced cases of pulmonary tuberculosis. Of the 22 *early cases*, 11 complained of symptoms referable to the digestive tract. Of this number, 3 suffered from symptoms prior to, and the remaining 8 subsequent to, the development of cough, fever, etc., symptoms common in early lesions. In this series the high point in the gastric curve occurred at or before the one and one-quarter hour period in 11 instances, 3 of which presented symptoms, and 8 no symptoms. One may therefore assume that when the high point occurs previous to this interval, symptoms are infrequent. In the 11 cases in which the high point occurred after the seventy-five-minute period, symptoms were present in 7 and absent in 4. The symptoms were no doubt due to a delay and

¹ Journal of the American Medical Association, 1916, vol. lxvii, No. 23, p. 1667.

² Correspondenz-Blatt schweizer Aerzte Basel, March 31, vol. xlvii, No. 13, p. 385.

³ American Journal of the Medical Sciences, 1916, vol. clii, No. 3, p. 355.

deficiency in gastric function. Nine of the 22 cases showed evidence of a "continued" secretion and were of the "hypersecretory" type, which I have described. They noted, furthermore, even though the patients possessed one of the normal types of curve, it by no means followed that they possessed normal appetites, but it is true that it is rare to note the reverse, that is, a normal appetite in patients exhibiting distinctly pathological secretory curves. Seven showed an excessive amount of mucus in one or more samples, or in the residuum. This condition occurred in patients complaining of gastro-intestinal symptoms. Lactic acid was present during the first hour in 9 cases; bile was noted in the morning residuum of 6 patients. No case of true hyperacidity was encountered in this group of early cases.

Advanced Cases. In this series of 25 cases, 24 complained of gastro-intestinal symptoms. The morning residuum revealed the presence of mucus, bacteria, and leukocytes in excessive amounts in 20 of the cases. The tubercle bacillus was present in the residuum of 18 cases. Fifteen cases showed a slow ascent, with a late high point and the evidences of "delayed" digestion. After the Ewald meal, food rests were found at the end of two and one-half hours in 18, or 72 per cent., showing a greater percentage of rests and therefore greater frequency of delayed motility in the advanced cases. In 8 cases the curve was of the "hyposecretory" type. Their conclusions are as follows:

1. Pulmonary tuberculosis causes a definite downward progression in both motility and secretory function of the stomach, from the very beginning of the disease.

2. Hyperacidity, with symptoms occurring in the early stages and described by previous writers as common, is rare. Even hyperacidity without symptoms is rare. The type which corresponds to the normal "hypersecretory" curve of Rehfuess existing in 40 to 50 per cent. of normal individuals exists considerably less frequently in early tuberculous patients. This would indicate that even in the early stages, changes in gastric function are present.

3. The so-called "pretubercular dyspepsias" of previous writers are misnamed, and we believe that they are in reality associated with definite tuberculous infection.

4. We do not believe, on the basis of our studies, that there is an irritative stage giving hyperacidity in pulmonary tuberculosis. Our studies suggest that the gastric disorder is the result of a disease of the gastric mucosa.

5. There is a distinct tendency toward the formation of a definite clinical syndrome known as delayed digestion which becomes more and more associated with symptoms as the disease progresses.

6. We believe, with Einhorn, that the swallowing of tuberculous pus or sputum plays a highly important role in the continuation and aggravation of disordered function. No less important are visceroptosis and gastrectasis.

7. The fractional estimation, with the development of secretory curves, is at present the most accurate way of studying the gastric function.

Gastro-intestinal Findings in Acne Vulgaris. There has always been an association in the minds of medical men between acne vulgaris and

gastro-intestinal malfunction. Ketron and King¹ have carefully studied this problem in 30 cases and gives tables and resumés of their results. Gastric abnormalities were present in 93 per cent., and intestinal disturbances in 70 per cent. The most common gastric findings were hyperacidity, 48.1 per cent.; retention, 36.6 per cent.; atony, 33.3 per cent., and ptosis, 40.0 per cent. The most common intestinal findings were cecal stasis, 46.6 per cent.; ptosis of the colon, 36.6 per cent.; and right lower quadrant adhesions, 23.3 per cent. Clinically, 63.3 per cent. of the cases gave evidence of gastric disturbances, and 40 per cent. showed constipation.

Their conclusions are as follows:

1. Acne vulgaris is generally conceded to be caused by the presence and growth of the acne bacillus.
2. There are a number of predisposing factors to this disease, one of the most important being gastro-intestinal derangements.
3. In a series of 30 cases of acne vulgaris, which were examined from the gastro-intestinal side, by test meals and fluoroscopic examinations, we found that none of them gave absolutely normal findings, and that 60 per cent. of them were cases showing abnormalities capable of permitting gastric and intestinal stasis followed by toxic absorption.

Gastro-intestinal Manifestations of Diabetes. Case,² in an *x-ray* study of 72 cases of diabetes, found gall-bladder involvement very common, especially gall-bladder lesions attended by pericholecystitic adhesions. The stomach in these cases generally shows increased rapidity in evacuation. Duodenal stasis, on the other hand, was a rare finding, nor was any marked increase in the length or caliber of the duodenum found. There is striking relation between the severity of the disease and the degree of iliac stasis. He found in fact that ileocecal valve incompetency was a common finding in this disease. Adhesions of the terminal ileum, stasis in the cecum and evidences of appendiceal disease were somewhat more frequent in the severe cases than in the mild cases. In diabetics, the average emptying time of the colon is delayed, the majority of cases showing a low-grade colonic stasis. Extreme colonic stasis was only found in 2 cases, both of which showed carcinoma of the distal colon.

Nasopharyngeal Infection as a Cause of Gastro-intestinal Disease. Andresen³ has pointed out the close association of infected foci in the causation of gastro-intestinal disease. With the few exceptions where these foci were situated in the skin, rectum, or pelvis, they were usually to be found in the mouth nose or throat.

In 136 cases of abdominal disease, he found the following infections:

Disease.	Total cases.	Pyorrhea.	Infections. Nose and throat.	Pelvis.	Skin.
Gastric ulcer	64	57	6	..	1
Appendicitis	41	26	3	11	1
Gall-bladder	18	17	..	1	..
Diabetes	5	5
Gastric cancer	8	8			

¹ Journal of the American Medical Association, vol. lxxvii, No. 9, p. 671.

² Ibid., 1916, vol. lxxvii, No. 12, p. 859.

³ Long Island Medical Journal, 1916, vol. x, p. 102.

The conclusions to be derived from the study of the facts is as follows:

1. The importance of infections of the mouth, nose, throat, in the etiology of infections of the gastro-intestinal tract has been definitely established.

2. The treatment of infective lesions must be modified to take cognizance of this newer knowledge and should include the following:

(a) Removal of infected foci as soon as possible, preferably before the institution of any other line of treatment.

(b) The use of autogenous vaccines made from the infective material obtained from any accessible source of infection.

DISEASES OF THE DUODENUM.

Duodenal Lavage. Jutte¹ discusses the value of the procedure known as transduodenal lavage. He uses it in the treatment of auto-intoxication, which he divides into two parts: *Histogenic intoxication* is due to abnormal function of the antitoxic glands and of the tissues; *enterogenic intoxication* is caused by the abnormal action of the digestive enzymes and of the bacteria on the food. The result of this action is the generation of numerous poisons and noxious substances, which, unless neutralized or removed, are absorbed into and circulate in the blood and at length give rise to auto-intoxication. For this purpose the method of transduodenal lavage is recommended.

Duodenal lavage flushes out the entire length of the intestinal tract from the pylorus to the rectum, according to that author. It bodily removes toxins; it restores, by simple cleanliness in the intestinal tract, the conditions necessary for normal bacterial growth, as shown by the results obtained; and in this way lays the foundation upon which the curative forces of nature may build the structure of returning health.

For duodenal lavage to be effective, it must be non-absorbable, it must be employed in bulk and of sufficient volume to flush the bowels. Furthermore, the material must be introduced directly into the duodenum. The treatment is easy to take, consumes only about fifteen minutes (after the tube is inserted into the duodenum) and is followed within an hour by one to three "pleasant watery evacuations, the patient feeling light, free, and buoyant."

The writer uses a duodenal tube which may be manually introduced and which, because of its small sinker, slips in and out of the duodenum easily.

A solution which usually passes through the bowel without being absorbed by the mucous membrane is 1 quart of water containing 9 grams each of sodium chloride and sodium sulphate. To make sure that the liquid will be passed on without being absorbed, it is sometimes well to add a small quantity of saturated solution of phenolphthalein. Other medication may be added, if indicated, such as sodium bicarbonate in acidosis, quinine in amebic dysentery, powdered medicinal soap (8 grains) in pancreatic insufficiency, resorcin in fermentation, chamomile

¹ American Journal of the Medical Sciences, 1917, vol. cliii, p. 733.

tea in inflamed mucous membranes. If silver solutions are indicated, the sodium chloride should be replaced by an additional quantity of sodium sulphate. The liquid is administered by a special bottle, and the method of treatment is described. I have used this same method with the Murphy drip on a number of occasions and have noted the loose movements that follow. Jutte describes some very excellent results with this method in ptomain poisoning, exophthalmic goitre, chronic headaches, and chronic diarrhea accompanied by putrefaction, biliousness, and mucous colitis. The method should be borne in mind when some of these conditions prove intractable.

Duodenal Infusion. McWhorter¹ gives a resumé of the uses to which duodenal intubation has been put, and describes a method of post-operative treatment by means of the duodenal tube. The tube is swallowed, or even passed into the duodenum at the time of operation, and the usual container and drip method is followed, and liquids are allowed to steadily enter the duodenum. It is pointed out that McArthur, who used temporary cholecystostomy for the purpose, claims that neither the Murphy drip nor Kanavel's continuous hypodermoclysis accomplish the same effect. In hypodermoclysis, a change in the splanchnic circulation is only secondarily affected, and in colonic instillation the improvement in the portal circulation is not so marked as when the same fluid bathes the jejunal lining.

This point serves as a means for emphasizing the importance of the duodenal tube for investigation. From the original tubes described by Einhorn and Gross, later modifications, such as those of Palefski and Rehfuess, seem applicable. It is now a recognized fact that the fine rubber tubes used by Einhorn can be supplanted by tubes of much larger caliber. By means of the tubes, which are inserted into the stomach first and then allowed to enter the duodenum by gastric peristalsis, it is possible to perform a number of procedures in ordinary gastro-intestinal work:—The diagnosis of pancreatic and biliary conditions (Einhorn, Gross, Crohn, McNeil, Hemmeter, Hess); the administration of nutritives as a means of dietetic therapy (Einhorn, Lazarus, Morgan, Jones, Gross, Hess); the direct application of medicaments to the duodenum (Skaller); and, finally, the culturing of the bile and the material from the small bowel (Garbat, Hess).

There is no question that duodenal intubation is becoming one of the fixed and important routine measures in the study of upper abdominal conditions, and, as such, merits attention. In a communication before the Pennsylvania State Medical Society, I pointed out some of its possibilities in gall-bladder diagnosis. Precision methods in the study of pancreatic disturbances and standardization of methods are desirable.

The Use of the Polygram in Gastroduodenal Diagnosis. Gerber² modifies the method of Levy Dorn of taking polygrams, that is to say, several exposures on the same plate, and finds it indispensable in this work. He makes two exposures on the same plate with an interval of eight seconds. This may be modified depending on the activity of the

¹ Journal of the American Medical Association, vol. lxxviii, No. 19, p. 1385.

² American Journal of Röntgenology, 1916, vol. iii, p. 20.

peristalsis and these polygrams are taken both in the upright and the prone positions.

In the normal stomach, the passage of the peristaltic waves can be seen graphically and in superimposing the outlines, they cross and recross each other, indicating activity of the whole stomach wall. In this way any regional defects in motility can be detected by an absence of these waves. In chronic gastric ulcer, it can be shown definitely that there is a part of the gastric wall involved which does not take part in the peristaltic conductivity. Craters or niches stand out prominently, while incisura will stand out as permanent grooves easily distinguishable from the criss-crossing peristaltic waves. In duodenal ulcer, the characteristic deformity is sharply shown, while in gastric carcinoma both the filling defects and the defects in motility can be shown in this way. It can be also of assistance in noting the pressure of extragastric tumors from the gall-bladder and other regions.

The polygram has the advantage that it records minute defects and constitutes a permanent record, and in a way saves the expense of the serial method, which the author does not deprecate.

Diverticulum of the Duodenum. Basch¹ describes an interesting case of diverticulum of the duodenum. This condition is comparatively rare, there being only about 70 cases reported in the literature. I am inclined to think that this number is rather too small, as acquired diverticula are possible. These pouches range from a few millimeters to 5 cm. in diameter, and usually exhibit a rather wide opening. The sac is generally found empty and flaccid, although it may contain food or food remnants. Many investigators, according to Basch, report the sac wall as consisting of mucous membrane and submucosa alone, the mucous membrane being smooth, thin, and free from glands. Diverticula occur only exceptionally on the outer or anterior surface of the duodenum; in most instances they are on the inner aspect in contact with the head of the pancreas, from which they are separated by loose connective tissue. Frequently they indent the head of the pancreas, or are intimately connected with the common bile duct or the duct of Wirsung, which usually lie behind the diverticula.

According to Basch, until the publication of Bauer's two cases in 1912, no serious clinical or pathological significance was attached to duodenal diverticula. In Bauer's first cases there had been signs of pyloric obstruction, and, despite posterior gastro-enterostomy, the patient died ten days after operation. The autopsy showed two duodenal diverticula, the largest one of which was about the size of a hen's egg, and situated in the inner side of the pancreatic duct, involving both the common bile and Wirsung's ducts. Bauer believes that this sac, through tension when full, caused an insufficiency of the pylorus and a stenosis of the duodenum. In Bauer's second case, the duodenal diverticulum was an accidental postmortem discovery. It was filled with a feculent mass and the duodenum itself was much inflamed, swollen and closed with a mucus plug. The common bile duct was dilated; the

¹ American Journal of the Medical Sciences, 1917, vol. clxiii, p. 833.

gall-bladder widely distended and filled with stagnant bile. Bauer concluded that in all probability the diverticulum, through its feculent contents, was the cause of the inflammatory changes in the duodenum and in the bile passages. In two of Wilkie's cases the diverticula were associated with grave disturbances in the adjacent organs, *viz.*, duodenitis and biliary stasis in both cases; in the first case, there was also an hepatic cirrhosis and in others an acute hemorrhagic pancreatitis. Wilkie is unwilling, however, to say with certainty that the diverticula were responsible for all the biliary and pancreatic troubles, but thinks there is strong presumptive evidence of an etiological relationship.

His conclusions are as follows:

1. Duodenal diverticula are of more frequent occurrence than would appear from the number of reported cases.
2. They can be diagnosed by *x*-ray examination when they form distinct pouches.
3. They may produce symptoms sufficient to require surgical interference.
4. They can be cured by operation.

Duodenal Syphilis. Mortimer¹ describes a case in which he made a diagnosis of syphilis of the duodenum on the following grounds:

1. History of onset, one year after marriage, birth of a syphilitic child, husband died of paresis. Both Wassermann reaction and symptoms cleared up previously under antisyphilitic therapy.
2. Presence of a hard irregular mass in the right hypochondrium.
3. Röntgen signs which showed decisive evidence of postpyloric pathology.
4. Positive Wassermann reactions.
5. Marked improvement under antisyphilitic therapy, patient stating that she was entirely free from abdominal pain and tenderness. Diminution in the size of the tumor.

Duodenal Ulcer. DUODENAL ULCER WITH ANACHLORHYDRIA. Crispin² reviews 11 cases of duodenal ulcer, operatively proven, in which gastric analysis showed an absence of free hydrochloric acid. Ten of the 11 cases were males. The one female, aged thirty-seven years, was the youngest. The oldest patient was sixty-six. The average age was fifty-four. Four of the patients used alcohol moderately; seven were moderate users of tobacco; and in no case was there a history of syphilis. In all there was weight loss, the greatest being 94 pounds, the least 5 pounds, and the average, not counting the very excessive loss of 94 pounds in one case, was 15 pounds.

It is interesting to note, regarding previous ailments, that 4, or 36 per cent., had typhoid fever on an average of twenty-four years before. Of the patients, 3 had abdominal operations; in 2 the appendix had been removed eight and six years, respectively, before the time of examination. The third patient had been operated on for gall-stones four years previously, but no stones were found; the gall-bladder was

¹ American Journal of Syphilis, St. Louis, April 1, 1917, No. 2, p. 473; *abs.*, Journal of the American Medical Association.

² Interstate Med. Jour., 1916, vol. xxiii, p. 890.

drained and the appendix removed. All the patients had pain or distress. The time of pain or distress was variable, beginning from one-half to four hours after meals. Night pains were recorded in 3 instances; 9 patients gave a history of vomiting; 2 patients had hematemesis; 9 complained of gas, belching, and bloating; 8 were constipated; 3 had diarrhea, 3 reported blood from the bowel.

In none of these cases was free hydrochloric acid found in the gastric contents. The lowest acidity was 4-0-4, the highest was 38-0-38; and the average was 15-0-15. Food remnants from the evening meal were withdrawn from the test breakfast in 6 of the cases. The largest amount of retention was 1200 c.c. In operating on these cases it was found that one was associated with empyema of the gall-bladder; 2 had perforated; in 3, there were also gastric ulcers, in 2, on the posterior wall and in 1 on the lesser curvature. In 5 of the cases, there was no disease of the upper abdomen other than duodenal ulcers. In 6 of the cases, marked obstruction of the duodenum was found at operation. In 1 case there were two ulcers on the anterior surface of the duodenum. In 5 out of 11 cases, the appendix was removed at the time of operation. Because of the ulcers, gastro-enterostomy was done in all.

REFLUX OF BILE AND PANCREATIC JUICE. Udaondo¹ reports the occurrence of bile and pancreatic juice regurgitation in 84.5 per cent. of his 13 cases of ulcer in the upper duodenum, and in 44.4 per cent. of the ulcers in the second part of the duodenum, while there was no spontaneous regurgitation in 88.8 per cent. of 27 gastric ulcers on, or near, the pylorus, and 87.5 per cent. of 32 cases of gastric ulcer remote from the pylorus. In another series of tests, he induced excessive duodenal secretion by the Volhard method and tested the gastric secretion for trypsin by the Gross method. Under these conditions, regurgitation was found in 99.9 per cent. of 11 high duodenal ulcers, and in 87.5 per cent. of 8 ulcers lower down. Also in 8.3 per cent. of 12 gastric ulcers on, or near, the pylorus, and in 33.3 per cent. of 12 remote from the pylorus. The author noted also that the percentage of trypsin was abnormally low when the ulcer was situated in the second part of the duodenum. [We know that this is a perfectly normal phenomenon concerned in the automatic regulation of gastric acidity. It is conceivable, however, that in gastric ulcer so frequently accompanied by pylorospasm this reflux might be checked and account for the high acid figures found in certain varieties of that condition. -*Reviewer*.]

DUODENAL ULCER AND ITS GASTRIC REPERCUSSION. Martini² discusses the important question of the effect of duodenal ulcer on the gastric function. He points out that the most interesting clinical symptoms are those which have to do with secretory and motor alterations in the stomach. He studies the gastric secretion both before and after the administration of the test meal and investigates gastric motility with the x -rays.

His studies revealed a marked peristaltic insufficiency [?] with a

¹ Rev. Soc. Méd. Arg., Buenos Aires, September, vol. xxv, No. 142, p. 245; abs., *Journal of the American Medical Association*.

² *Prensa Méd. Arg.*, 1916, No. 32, p. 381; abs., *Surgery, Gynecology and Obstetrics*.

median gastropptosis and abnormal elongation toward the right; hyperfunctional peristalsis, especially expulsive, but with slow and difficult pyloric evacuation, bismuth being found in the stomach six hours after ingestion.

The author found it difficult to make a diagnosis in the presence of the gastrosuccorhea type of Reichmann, which he considers adaptable to two types of duodenal ulcer: (1) When the ulcer is situated near the pyloric sphincter, and (2) when, besides its proximity to the sphincter, it is associated with cicatricial retraction and consecutive stenosis. A chronic duodenal ulcer complicated by stenosis modifies entirely the clinical aspect of a simple ulcer of the same nature. The syndrome of gastric hypersecretion, of the permanent type of Hayem, is the most eloquent manifestation of duodenal ulcer.

Congenital Stenosis of the Duodenum in the Adult. Terry and Kilgore¹ describe an interesting case of congenital duodenal stenosis in an adult, a man of twenty-four years, whose illness began at twelve, with a year of rather intermittent pain in the lower abdomen, followed by three and one-half years of freedom, then four years more of similar attacks at intervals of three or four weeks. The pain was always below the umbilicus.

Operation disclosed some old adhesions around the stomach but none about the duodenum, with the exception of two fine strands between the pylorus and the gall-bladder. The first part of the duodenum was dilated, the upper wall forming a definite pouch. Just distal to this pouch, at the junction of the first and the second parts of the duodenum and above the entrance of the common duct, the intestine was evenly constricted to one-third or less of its diameter for a distance of 1.5 cm. There was no thickening of the wall and no scars could be found, and no abnormalities of the peritoneum to account for the constriction.

He died after operation from marked gastric dilatation and leakage of the gastro-enterostomy opening, with peritonitis, and an examination of the duodenum revealed a normal duodenal mucosa lining the constriction with no evidence of scar formation.

DISEASES OF THE GALL-BLADDER AND DUCTS.

Gall-bladder. Meltzer² discusses the LAW OF CONTRARY INNERVATION as a pathogenic factor IN DISEASE OF THE BILE DUCTS AND GALL-BLADDER. The gall-bladder, like the urinary bladder, represents a simple mechanical device by means of which a continuous glandular secretion is transformed into a discontinuous elimination while the secretion of bile is continuous, the discharge of bile through the common duct into the duodenum only occurs periodically from the quiescent gall-bladder. Meltzer considers this advantageous inasmuch as it is possible that its emission during rest periods may do harm. Bile, in health, may contain bacterial organisms which may be eliminated in this way. Adam, and

¹ Journal of the American Medical Association, 1916, vol. lxvi, p. 1774.

² American Journal of the Medical Sciences, 1917, vol. cliii, p. 469.

several French observers, found that the circulation may, in health, contain pathogenic organisms like the colon bacillus. As to disease, the systemic circulation may become loaded with pathogenic microbes. Two things prevent more common infection of these organs—intact mucous membranes and lack of stasis: Stasis itself may lessen mucosal vitality and both together account for trouble. Physiological quiescence of the gall-bladder, if abnormally prolonged, or even in itself, may, to use Meltzer's term, harbor a pathogenic element. He discusses such a mechanism by bringing to play the law of contrary innervation which Meltzer and others have insisted upon as an important factor in disease production. In other words, evacuation is controlled by antagonistic activities of muscle groups. For instance, the gall-bladder is well provided with muscle fibers, the contraction of which will free the gall-bladder of its fluid contents. As to the termination of the common duct, Oddi described some thirty years ago that the papilla of Vater is provided with circular muscle fibers which, by their contraction, close up the common duct. This contraction is sufficient to resist a pressure much higher than that which obtains in the gall ducts. It is clear that the muscle fibers in the gall-bladder and those in the papilla are antagonists. During bile storage the muscle fibers of the papilla are contracted and those of the gall-bladder inhibited; during the discharge, the gall-bladder contracts and Oddi's muscle is relaxed; the bile has then no other way but into the duodenum. The innervation of the concerned parts, although not yet settled in its details, is very interesting. According to Doyon, stimulation of the peripheral and of the splanchnic nerves causes simultaneously a contraction of the gall-bladder and an inhibition of the tonus of Oddi's muscle. The vagus, on the other hand, seems to contain motor fibers for the sphincter of the common duct and inhibitory nerve fibers for the gall-bladder. Furthermore, also, the different innervations show the character of contrary innervation. For instance, stimulation of the central end of the vagus causes simultaneously a contraction of the gall-bladder and an inhibition of the sphincter muscle.

It is quite clear that the physiologically discontinuous character of bile flow into the duodenum is regulated by a reflex mechanism, dominated by the law of contrary innervation that the integrity of the gall-bladder is an important part in this reflex mechanism; that the discharge of bile can be greatly curtailed or restricted by the absence or restriction of the discharge of chyme from the stomach, and that the discharge of bile through the papilla of Vater into the duodenum is greatly enhanced by the presence in the latter of peptones and albumoses.

Now it is probable and Meltzer raises the question that even slight disturbances can affect this physiological mechanism adversely. We need, for instance, only to assume that by some mental excitement tonic contraction of the sphincter of the common duct, at the period assigned for discharge, does not relax, while the gall-bladder contracts normally, resulting in abnormal stasis of the bile ducts which may lead to icterus—emotional jaundice. Or both muscles may be abnormally

contracted, leading to colic, with consecutive jaundice without catarrh or calculi, at least not in the first few attacks of short duration. When such processes occur often, biliary stasis leads to inflammatory processes and their consequences, and even to biliary calculi. If the individual is going through an infectious process, they may set in sooner. Again, aberrant food ingestion, continuous fasting, infrequent or irregular feeding may gradually, by prolonged stasis, induce pathological consequences. Psychically disturbed internal secretions, altered character of food, all may play a part. Furthermore, the experiments of Rost that peptones and albumoses caused discharge of bile indicates that abstaining from protein foods or their infrequent ingestion may cause trouble in this way.

In health, Meltzer advises taking frequent meals, not necessarily of large quantities, but containing peptones and albumoses; he even recommends the direct administration of peptone in capsules as possibly useful in infectious disease as well as in some of the biliary disorders.

This paper on frequent feeding and peptone offers much food for thought.

ETIOLOGY OF CHOLECYSTITIS AND GALL-STONES. Rosenow¹ describes the experimental phase of the bacterial production of stone and cholecystitis. His tabulation of the results of cultures from gall-bladders removed at operation, as well as the culture of the stone itself, are interesting and serve to establish one more link in the chain of the elective localization of streptococci. Streptococci and the colon bacilli are the principal organisms found in these cultures and the results on animal inoculation are somewhat different. Streptococci and colon bacilli from acute cholecystitis gave rise to more marked lesions in the dog than did those of chronic cholecystitis. In some strains the virulence could be diminished by cultivation and increased by animal passage, and the affinity for the gall-bladder was still retained. Usually, however, this affinity was lost. Strains grown on artificial media acquired distinctly greater affinity for the stomach and the appendix, while those passed through animals acquired a greater affinity for the pancreas. This latter point is very important.

In Case 120, ulcer was produced in animals with the streptococci isolated from the lymph gland draining the duodenal ulcer, and cholecystitis was produced with streptococci from the gall-bladder. The results furnish experimental evidence that ulcer and cholecystitis in the same patient at times may be due to hematogenous infection by streptococci which have these respective powers of localization. A single strain, however, may have affinity for both structures, as shown in numerous experiments.

The simultaneous occurrence of lesions in the gall-bladder and in the cystic and common ducts following injection of the streptococcus from the gall-bladder where these structures were involved, indicates that the lesions may be due to a wide range of affinity of the infecting microorganism. The occurrence at the same time of cholecystitis and

¹ Journal of Infectious Diseases, 1916, vol. x, p. 527.

pancreatitis in the animals injected with bacteria from acute cholecystitis and pancreatitis, and with strains from chronic cholecystitis and from ulcer after animal passage suggests that the simultaneous presence of the diseases in the same patient is due commonly to hematogenous infection and not so often to lymphogenous or local invasion as the findings at operation so often appear to indicate.

The demonstration of streptococci in the involved tissues in a high percentage of cases in chronic cholecystitis, the elective affinity of these organisms for the gall-bladder in animals, and the production of the disease with the strains isolated from experimental lesions, indicate that streptococci are a cause of cholecystitis. The importance not only of draining but removing the gall-bladder is apparent, especially in the absence of stones, as already emphasized by Mayo and others. This is especially true in cases of chronic cholecystitis. Gall-bladders removed in chronic cholecystitis during the quiescent interval have been demonstrated to be the host of living bacteria. Might not the periodic exacerbations be due to resumption of activity on the part of the latent infection, when the defensive mechanism of the individual is low? The fact that streptococci which produced marked cholecystitis by systemic intravenous injection failed to produce cholecystitis when injected into the radicles of the portal vein, or when injected directly into the gall-bladder, is crucial evidence that cholecystitis in the absence of stones is very frequently a hematogenous infection, and rarely the result of invasion from the bile.

The results of differential cultures in both spontaneous and experimental cholecystitis show the colon bacillus is commonly a secondary invader in an infection with streptococci or in a mechanical injury produced by previously formed gall-stones. That it is the primary cause of cholecystitis in some instances is quite certain, because one of a series of strains of the colon bacillus from cholecystitis was present in pure culture and showed elective affinity for the gall-bladder in animals. In one case, cholecystitis, which had begun during convalescence in typhoid fever, was proved to be due to streptococcus, hence it would seem that cholecystitis occurring in typhoid fever is not always due to the typhoid bacillus.

The common presence of bacteria in the centers of stones, the formation of gall-stones in association with cholecystitis following injection of streptococci as observed in 9 cases, and the presence of streptococci in the newly formed stones, emphasize anew the important role which infection plays in the etiology of gall-stones. The almost complete absence of bacteria in the 4 pure cholesterol stones is in accord with the views of Aschoff, Henes, and others, who emphasize the importance of a high cholesterolemia as a causative factor in the formation of gall-stones. Streptococci have been isolated from the walls of gall-bladders and demonstrated there in cases of chronic cholecystitis without stones. It would appear, therefore, that for the formation of gall-stones two factors are necessary: (1) Infection furnishing the nucleus for the precipitation of bile salts, etc., and (2) a concentrated bile of high cholesterol content.

THE DIETETIC MANAGEMENT OF HYPERCHOLESTEROLINEMIA IN CASES OF CHOLELITHIASIS. Rothschild and Rosenthal¹ discuss the very important question of the management of the hypercholesterolinemia accompanying many cases of cholelithiasis. Chauffard in particular, but many other authors, have drawn attention to the association of an increased cholesterol-content of the blood stream with gall-stone formation. In Chauffard's classical work, "*Leçons sur la Lithiase Biliare*," he completes the argument and reviews the experimental work of his associates and others engaged in this work. In that contribution, which is complete, Chauffard reviews the association between an increase in blood serum cholesterol and the cholesterol of bile in the gall-bladder, and draws attention to many points not discussed in the above papers, namely, the significance of disturbance in the ductless glands, such as the adrenals and the corpora lutea, as well as reference to the changes of the cholesterol content in the blood during, and after, typhoid fever and pregnancy, two conditions which have been associated with this finding. In that same work, Chauffard points out the fact that there are two different contributing factors toward increased cholesterol, one endogenous and the other exogenous dependant on the cholesterol of the food.

It is clear, however, that in a certain proportion of cases this increase of cholesterol plays a very important role, in other cases its significance is less pronounced and possibly other factors, such as infection or alteration in pigments play the predominating role. Our statistics, which are very much larger than Rosenthal and Rothschild nevertheless emphasize many of the points which they have described. Henes pointed out that this hypercholesterolinemia could be used in diagnosis, but as the above authors point out and we have been able to confirm, there is a type of stone in which increased cholesterol is not found, but in which presumably it was present at the time of their formation.

It is evident that from these results that the cholesterol content of the blood may be variable in this condition. Concomitant pathological or physiological factors that may cause a hypercholesterolinemia must be considered in each case. For example, in arteriosclerosis or chronic nephritis we find a hypercholesterolinemia even though stone be absent. Similarly, patients with pyloric obstruction or repeated vomiting, or those in a state of inanition, may show a transient hypercholesterolinemia even in the presence of an ulcer. Conversely, all cases of cholelithiasis do not show a hypercholesterolinemia. Thirty-seven cases examined by the authors gave the following figures.

0.425 per cent.	0.237 per cent.	0.205 per cent.	0.162 per cent.
0.350 "	0.237 "	0.205 "	0.162 "
0.33 "	0.235 "	0.2 "	0.16 "
0.325 "	0.218 "	0.2 "	0.15 "
0.29 "	0.215 "	0.2 "	0.15 "
0.287 "	0.212 "	0.19 "	0.145 "
0.281 "	0.212 "	0.175 "	0.135 "
0.275 "	0.2115 "	0.17 "	0.132 "
0.272 "	0.207 "	0.166 "	0.132 "
0.25 "			

¹ American Journal of Medical Sciences, 1916, vol. clii, p. 394.

The highest hypercholesterolinemia was found in cases that were jaundiced. In general, it may be stated that cases of cholelithiasis do show a hypercholesterolinemia. However, in 12 cases there was a normal cholesterol content of the blood, yet gall-stones were demonstrated at operation. The explanation of this group evidently lies in the fact that at some previous period a hypercholesterolinemia was present, as precipitation stones were found in the gall-bladder which automatically reduced the hypercholesterolinemia. Unless the same physiological and pathological factors that originally caused the hypercholesterolinemia persist after the formation of the stones or unless obstruction results from the stone formation, the hypercholesterolinemia will not reappear. A simple obstruction of the cystic duct will not produce a hypercholesterolinemia. The presence of infection will reduce the cholesterol content of the blood even in cases of cholelithiasis. In 3 such cases an empyema of the gall-bladder was noted, and in 2 of them the cholesterol content of the blood was 0.132, 0.135 and in the third 0.175 per cent.

We have observed cases in which the gall-bladder had been removed, and in some of which the common bile duct had been drained, and despite the removal of the gall-bladder, thus theoretically reducing the chances of stagnation in this organ, a hypercholesterolinemia persisted not assignable to any determinable cause.

This has led us to divide our cases of cholelithiasis into the following groups:

Group (1). Cases that have a normal cholesterol content of the blood.

Group (2). Cases that are hypercholesterolinemic. The hypercholesterolinemic cases are in turn divided into the following groups:

A. Obstructive hypercholesterolinemia	Temporary	{	Stone.
			Stricture.
B. Diathetic hypercholesterolinemia	{	{	Newgrowth.
			Intermittent.
			Permanent.

We shall not enter into a lengthy discussion of Group 1. In this group are included stone cases which subsequently may be placed in Group 2. As an example, a patient with an empyema of the gall-bladder may be hypocholesterolinemic because of the infection, but, with the removal of the gall-bladder and the subsidence of the infection, a condition of hypercholesterolinemia may be established and the case would then belong in Group 2.

The obstructive hypercholesterolinemias in Group 2 are called temporary, as with the removal of the obstruction the hypercholesterolinemia disappears. For instance, a patient with an afebrile obstructive jaundice is hypercholesterolinemic. With the removal of the obstruction the cause of the hypercholesterolinemia is likewise removed, the cholesterol content of the blood returns to normal and the patient belongs in Group 1.

There is, however, in Group 2 a second class of patients who are more or less continuously hypercholesterolinemic. These we have called the diathetic group, or those having a cholesterol diathesis.

Regarding the diet, those articles of food which are rich in lipoids are excluded. They include eggs, cream, butter, meat, and fish. On a strict, practically lipoid-free diet, only vegetables are permitted, excluding peas and beans which are rich in phytosterol which is an isomere of cholesterol. All other vegetables, such as cereals and sugars, are permitted. The milk should be skimmed, and fat-free buttermilk permitted. This diet is so strict that the majority of patients will not entertain it for a long period; therefore the authors have devised "fast and feast days." For three or four days a week, the patient lives on a strict, lipoid-free diet outlined above, the so-called fasting periods which serve to deplete the organism of stored-up food products. For the next three or four days, dependant on the degree of hypercholesterolemia, a more liberal diet is permitted, the so-called feast days. On the "feast" days, the patient is permitted, in addition to the articles above, well-cooked lean meats and fish, including salmon, shad and bluefish. Oleomargarine is allowed instead of butter.

DIAGNOSIS OF GALL-BLADDER DISEASE. Cheyney¹ says that chronic cholecystitis must exist before stone, an opinion which, in the light of our recent knowledge of hypercholesterol and bile stasis, seems a little bit too strong. Although his cases are but few in number, in this paper he has insisted on some of the most important points in gall-bladder diagnosis. The habit of the chronic gall-bladder to masquerade under gastric symptoms is well exhibited in several cases under discussion.

The statement that gall-stone colic does not follow the orthodox description will be borne out by any observer who has seen much of these cases; in a number of instances the author has seen unquestioned biliary colic, confirmed subsequently by operation, confine itself to the epigastrium or even to the left costal margin. The explanation is probably to be found in a generalized spastic contraction, pylorospasm and even gastrospasm, as has been described by certain observers. Cheyney doubts the value of the *x*-ray studies in spite of the perfection of recent methods, and mentions one case in which the plate showed shadows interpreted to mean gall-stones, but no stones were found at operation.

Chronic appendicitis is the most difficult condition to diagnose from chronic cholecystitis. Either may give rise to fever, chills, even jaundice and vomiting, and while appendicitis may have pain referred to the right costal margin and to the back, gall-stone colic may have pain exceptionally referred down to the right side of the abdomen.

A large gall-bladder usually means stone in the cystic duct, and, in such cases, the liver often projects a considerable distance below the costal arch in the form of so-called Riedel's lobe. Jaundice did not occur in Riesman's² cases of cholecystitis, although it does occur, particularly in cholecystitis with angiocholitis, and I have in mind at the present moment such a case with repeated drainage and still a persistence of infection.

¹ American Journal of the Medical Sciences, 1917, vol. cliii, p. 477.

² Ibid., p. 492.

Riesman considers the absence of jaundice after biliary colic as without significance. He mentions the possibility of left-sided pain and, in discussing Cheyney's paper, I pointed out what seemed to me to be true. In the past year I have seen 3 cases of gall-stone colic with left-sided pain, confirmed by operation. Riesman says that the x-rays show the stone in 50 per cent. of cases. This seems questionable. I have spoken to a number of our best röntgenologists and I question whether, even utilizing the negative shadows, such as Cole described, it is possible to accurately diagnose cholelithiasis in 50 per cent. of the cases.

Attention is called to the fact that even pleurisy and pneumonia may counterfeit the picture of gall-bladder disease. This is true, and it might be added that even jaundice can be added to this picture through the intermediary of a pneumococcic infection. Riesman calls attention to a point which, it seems to me, is extremely important, namely, the question of the differential diagnosis of the epigastric and thoracic reflected pains of gall-stone disease and those of angina pectoris. I would add to those the group of false anginas mostly spastic or vagotonic in origin. In a certain number of gall-stone cases, cardiac symptoms are present.

Gastric Symptoms. Cheyney¹ discusses the gastric symptoms accompanying gall-bladder disease. In the first place, stomach trouble, according to Cheyney, presents three possibilities: (1) Organic disease of the stomach itself; (2) gastric disturbances entirely due to disturbance elsewhere than in the stomach, without any pathological change in the stomach; (3) they may be due to "neurasthenia" and no recognizable change can be found in the stomach or other organs. The third group, he says, is a steadily diminishing one, and the two great factors in the second group producing gastric disturbances are chronic appendicitis and chronic cholecystitis. In this paper he deals with the gastric disturbances produced by gall-bladder disease. From 1912 to 1917, 62 cases came into the gall-bladder group, 19 of these were chronic cholecystitis, and 43 cholelithiasis. These he divided into three groups: (1) Those without any gastric complaint between characteristic gall-bladder attacks. (2) Those with a mixed picture of gall-bladder attacks at longer or shorter intervals with almost constant stomach trouble. (3) Those in which the gastric disturbances were predominant and the gall-bladder attacks so slight as to throw doubt on their existence.

The first group consisted of 30 cases, 5 were diagnosed chronic cholecystitis, 4 operated on and the diagnosis proven, with negative findings in the stomach; the other 25 were diagnosed cholelithiasis, 11 were operated on and stones found, but nothing was discovered in the stomach. Gastric analysis was made in 13 of these cases. Five showed hyperacidity with a total acidity above 65, 6 showed subacidity, with a total acidity under 30, and 2 gave a normal total acidity, one 50 and one 56. He asks the question why with decided abnormality in secretion were there no gastric symptoms in 11 of these cases.

In the second group, there were 28 cases; with constant food distress

¹ Archives of Diagnosis, April, 1917, p. 164.

as well as the intermittent attacks of biliary colic. Distress, fullness, gas, belching, constant nausea and frequent vomiting, sour stomach, sour eructations, and pain. The danger in these cases is that the gastric symptoms so markedly predominate that the slight symptoms referable to the gall-bladder may be altogether crowded out. Four cases were diagnosed as chronic cholecystitis, were operated upon, and the gastric symptoms disappeared after drainage of the gall-bladder. Three cases diagnosed cholelithiasis, likewise operated on, after removal of stones and drainage lost their gastric symptoms. Of the remaining 21, treated medically, many were improved, but none permanently cured. As regards the analysis, the most common finding in this group was hyperacidity; 15 of the 27 showed this condition, but 7 showed a decided subacidity and 5 gave an analysis within normal limits. Several other interesting cases are given in detail.

More than one-half of the cases reported by Wohl¹ showed either a great diminution or either absence of free hydrochloric acid.

In 11, out of 40 cases, or 27.5 per cent., a complete absence of free HCl. In other words, in 55 per cent. the free HCl was below normal. In 3 cases (7.5 per cent.), there was hyperacidity; in 15 (37.5 per cent.), HCl was normal. In not one instance did he see free HCl with what looked to be a normally functioning gall-bladder.

In Hohlweg's² series 84 per cent. of cases of functionless gall-bladders showed a deficiency of free HCl. It was pointed out that in 69 per cent. of cholectomized patients, the gastric contents, examined one to five years after operation, showed a deficiency or total absence of free HCl.

X-RAY DIAGNOSIS OF GALL-STONES. O'Brien³ uses a fast, finely grained intensifying screen in all gall-bladder work. This he considers essential, and he insists upon the fact that the patient should not breathe during exposure. This screen is of especial value in the robust and corpulent, and cuts down the exposure time very markedly. A small diaphragm and a small cone are also essential factors in the successful search for gall-stones. In abnormally placed gall-bladders, which are not infrequent, the search must extend over a larger area than the commonly accepted region for this work. They may be found anywhere in the lower or right upper quadrant, and even to the left of the median line in rare instances.

Case⁴ discusses this same subject and groups his results as follows:

1. Positive x-ray finding of stone, with stones at operation, 20 cases out of 41, making a percentage of 49 per cent. diagnosable by this means.
2. Positive report and no stones at operation, 4 cases.
3. Negative report and no stones found at operation, 244 cases out of 257, making 95 per cent. of successful negative diagnoses.
4. Negative report and stones found at operation, 13 cases, failure to diagnose in 5 per cent.

¹ New York Medical Journal, February 24, 1917, p. 347.

² Deutsch. Arch. f. klin. Med., 1912, p. 259.

³ Boston Medical and Surgical Journal, 1916, vol. clxxiv, p. 309.

⁴ American Journal of Röntgenology, 1916, vol. iii, p. 246.

5. Report of probable gall-stones; out of 22 cases, 8 were found to have stones, and in 14 no stones were found, but 11 had diseased gall-bladders.

Out of a total of 55 cases with diseased gall-bladders, x-ray evidence pointed definitely to this condition in 48 cases, or in 88 per cent., while gall-stones were accurately shown in 50 per cent. of all cases where they were present.

INSECT IN THE GALL-BLADDER. Neugebauer¹ describes the case of a woman, aged forty-three years, in whom operation on the gall-bladder disclosed a large number of small calculi among which was an insect 8 mm. long. It was identified as the larva of the "*forficula auricularia*" a common insect which could have easily reached the human digestive tract with foods, such as salads and fruits.

Nichols² takes up the question experimentally regarding GALL-BLADDER DISEASE CARRIERS. In the treatment of typhoid, cholera, and bacillary dysentery, one of the most important problems seems to be the prevention and cure of gall-bladder and gall-passage infections. Nichols experimented on the rabbit.

He calls attention to the fact that, in typhoid, the gall-bladder lesion might be due to a descending infection of the bile from the liver, to an ascending infection from the intestine, or to a transverse infection through the gall-bladder by way of the bloodvessels. As a result of his experiments, Nichols arrives at the following conclusions:

The theory of the production of gall-bladder lesions in typhoid by the descending infection of the bile from the liver receives some support. Increasing doses of the bacteria cause a corresponding increase of bacilli in the bile, and an increasing number of gall-bladder infections are seen with increasing doses. More bacilli appear in the bile after mesenteric injection of the culture than after injection into the ear veins. More lesions likewise result from mesenteric injection. More bacilli appear in the bile after injection of the same dose in immunized animals than in normal animals, and more lesions result in immunized animals. In cholera and dysentery, the same mechanism suggests itself, with the additional factor of portal septicemia. Previous injection of sodium bicarbonate seems to partially protect these animals, and it is suggested that the antiseptic property of the bile is in part due to its alkalinity.

It seems advisable at this point to mention briefly the question CHOLECYSTECTOMY VERSUS CHOLECYSTOTOMY in the surgical treatment of gall-bladder disease. This question, while strictly in the province of the surgeon, is nevertheless a question which every physician should know something about. The article by Guthrie³ is well worthy of perusal by anyone interested in this question. It is interesting to note that Dr. Noble, in discussing this paper, points out some rather pertinent facts regarding the gall-bladder in this day when ruthless surgery, as well as ruthless warfare, is practised. Dr. Noble insists upon the

¹ Zentralbl. f. Chir., 1916, No. 24.

² Journal of Experimental Medicine, 1916, vol. xxiv, p. 497.

³ Journal of the American Medical Association, 1916, vol. lxxvii, No. 9, p. 647.

fact, well known to every surgeon of experience, that when the gall-bladder is removed, nature attempts to form a new gall-bladder, or at least a diverticulum. Florcken reported a case of the *regeneration of the gall-bladder* with the formation of stones two and one-half years after operation. Other cases have been reported, and I have been surprised to note the frequency with which good surgeons have found this condition. This fact alone argues for the importance of the gall-bladder, and Meltzer's admirable paper, which is reviewed in these columns, shows the intricate mechanism with which surgery must deal. Halsted and Opie showed that pure bile, when injected into the pancreatic ducts, produced a violent and dangerous pancreatitis, whereas bile mixed with mucus produced only a mild inflammation of that organ. Kemp, of London, in some of the earliest experiments, showed that there was a difference in the alkalinity and chemistry of the bile before and after it entered the gall-bladder. Furthermore, it is to be remembered that bile is only needed at intervals in digestion and the elaborate mechanism so beautifully controlled by antagonistic muscle groups, as shown by Meltzer, is destroyed by this operation. I have always been in favor of removal of the organ when it was diseased, but its wholesale removal without any consideration of the above facts is unjustifiable. Not infrequently the ducts are involved as well, and it must also be remembered that calculi can occur in the ducts or even in the small hepatic radicles.

DISEASES OF THE LIVER.

Icterohemorrhagic Spirochetosis (Weil's Disease). Renewed interest has attached itself to the discussion of this condition owing to its outbreak on several occasions since the beginning of the war. Weil first described the disease in 1886. It was characterized by jaundice, pyrexia, hemorrhages, and the fact that it was apparently infectious, as it occurred either in widespread epidemics or localized groups of cases. Stokes and Ryle¹ go into the subject rather thoroughly and discuss the various points regarding this condition.

ETIOLOGY. In 1914, Inada and Ito reported the discovery of a spirochete in the liver of a guinea-pig which had been injected with the blood of a person who was suffering from Weil's disease. In 1915, these authors came to the conclusion that the spirochete was the cause of Weil's disease. They found that the blood of patients recovering from the disease contained substances which could be considered protective against the organism; furthermore, when they injected the blood of patients with Weil's disease during the first five days of the disease into the peritoneum of the guinea-pig, the animal developed albuminuria, pyrexia, and jaundice, and they were able to show the organism in the liver and blood in large numbers. They were able to pass the strain from animal to animal and in one strain they had reached fifty generations. Their experiments further indicated that the organ-

¹ British Medical Journal, September 26, 1916.

isms disappear from the blood coincident with the formation of the immune substances. At some period after the tenth day, the organisms appear in the urine and they were able to demonstrate them by means of dark-ground illumination and animal inoculation. They have been able to find organisms in the urine as late as the thirtieth day.

MODE OF INFECTION. Weil believed that the entrance of infection was through the alimentary canal. Inada supports this view, but Ido and Oki have noticed that the disease sometimes begins with swelling of the lymphatic glands, and they have further been able to communicate the disease to animals by applying the infective material to the uninjured skin. However, they judge that infection from man to man is rare. There is also a possibility of infection being carried by mosquitoes or vermin, a point which is not quite clear.

GENERAL CLINICAL PICTURE. On admission, the most striking picture is jaundice and extreme injection of the conjunctivæ, accompanied by great prostration.

Alimentary System. The tongue is very dry, brown, and fissured. In a certain number of cases hemorrhagic herpes labialis occurs. Hepatic enlargement is rare, and, according to Stokes and Ryle, splenic enlargement was never encountered. All patients were constipated, but the stools were of normal color and bulk. In some cases, there was blood in the dejecta. Vomiting in the early stages occurred in every case. Diarrhea was not noted in any case. Appetite, which was lost during the period of pyrexia, returned as soon as the jaundice began to fade. Hiccough occurred in the two most serious cases, one of these terminated fatally. One fatal case had uncontrollable hemorrhage from the bowel; in the other case, traces of blood were passed by bowel.

Circulatory System. The pulse rate was slow in proportion to the pyrexia, and there was a very definite slowing during convalescence. In 2 of the more severe cases, there was a rapid pulse during the first week. The tension and volume were good, even late in the fatal case. There was no evidence of cardiac dilatation.

Respiratory System. There was no evidence of respiratory complications, but, in the acute stage, a little blood-tinged sputum was noted. In 2 cases where hiccough occurred, a peculiar catchy type of inspiration was at times noted.

Excretory System. Two cases had difficulty in micturition, for which there was no obvious cause. The urine contained bile, and there was slight albuminuria during the pyrexial period in all cases. Acetone was found in the urine of the fatal case.

Nervous System. Sleeplessness due to severe pains was common in the early stages; in the more grave cases, torpor was noted, and, in one fatal case, this progressed to the "typhoid state," with rambling delirium and muscle tremors. Pruritus due to jaundice occurred in 3 cases.

Lymphatic System. All cases showed enlarged glands. The pectoral group of the axillary glands were most often felt as discrete shotty nodes on the thoracic wall of the axilla. Glands in the neck and groin were also felt. These were sometimes tender on pressure. The spleen

was never palpable, and percussion did not show an increased area of dulness.

The Skin. Varying degrees of jaundice were seen. It was usually of a lemon or orange tint, and never approached the greenish color of obstructive jaundice. The color rapidly increased, and as rapidly decreased as convalescence set in. The degree of jaundice was not constant for two successive days, and was always most striking in severe cases. The date of the appearance, so far as they know, is the fourth day. Petechial hemorrhages only occurred in one fatal case.

Fever. All the cases showed an irregular pyrexia descending by lysis. Subnormal temperature was common in early convalescence and also preceded death in one instance.

Prognosis. From the cases observed, it would appear that there are both mild and very severe cases of Weil's disease. The jaundice, weakness, and pain in some cases have been slight and not of long duration. On the other hand, there have been 3 deaths, and at least 2 other cases which were very ill.

Stokes and Ryle give in detail the history of 10 cases.

The spirocheta found in this disease on dark-ground illumination were rather straight, with curves resembling the *S. refringens* rather than those of the *S. pallida*.

The authors, in conclusion, believe that the cause of epidemic jaundice, from their observations in Japan and Flanders, is identical.

Acute Yellow Atrophy of the Liver. CASE OF ACUTE YELLOW ATROPHY OF THE LIVER TREATED BY INJECTIONS OF SODIUM BICARBONATE: RECOVERY. C. P. Longridge,¹ Royal Army Medical Corps, relates the case of a soldier, aged twenty-five years, who having reported ill at Gallipoli was sent to a hospital in Egypt. The symptoms pointed wholly to epidemic catarrhal jaundice, which was prevalent at that time. In a few days severe symptoms appeared, including syncope and vomiting. Icterus became marked. Liver dulness increased. Received by the rectum glucose injections, with sodium bicarbonate by the mouth. Leucin and tyrosin were present in the urine. The symptoms grew worse, and delirium set in. Glucose enemata were no longer practicable. Sodium bicarbonate was then injected hypodermically. The patient was now unable to receive food, and the urine was almost suppressed. Diagnosis of acute yellow atrophy of the liver was made in consultation. The sole dependence was placed on the bicarbonate injections. One week after the patient was admitted to the hospital, he began to improve, the liver dulness rapidly receding. The man was discharged cured on the twenty-third day.

Subacute Yellow Atrophy of the Liver. Fraser² describes an interesting case of the above condition in a boy of six years, in whom there was enlarged abdomen, increase in superficial veins, marked ascites, enlarged liver. These findings at postmortem were compared with experimental findings on 12 dogs and 1 cat after the injections of fatal doses of diph-

¹ Presse médicale, August 31, 1916.

² American Journal of the Medical Sciences, 1916, vol. clii, p. 202.

theria toxin. His studies, which include both postmortem and histological reports, led him to the following conclusions:

1. It appears not improbable that many cases which pass clinically for ordinary cirrhosis of the liver in children are actually instances of subacute atrophy of the liver, such as I have reported above.

2. Histologically, the chief feature in that case was the extensive central hemorrhage and necrosis, with marked thrombosis and necrosis of the terminal central veins, followed by replacement fibrosis together with degenerative changes.

3. I think it worthy of suggestion that the primary change is necrosis of the terminal hepatic veins, and that this is caused by some bacterial toxin. What that toxin was could not be determined. The history of the case is meager, but, apparently, the patient had pneumonia twice.

4. Exactly similar conditions in which there are present necroses of the terminal hepatic venules and capillaries and extensive central hemorrhage and necrosis caused by bacterial toxins can be positively demonstrated by the invariable result found in the 13 animals injected with diphtheria toxin. Whether subsequent regenerative and fibrotic changes can be brought about in this way must be determined by further experimentation.

Liver Cysts. Fowler¹ described an ECHINOCOCCUS CYST in the left lobe of the liver discharging into the left hepatic duct in a female, aged twenty-one years, who gave a history of recurrent epigastric pain, nausea, and jaundice for the past four months. She submitted to two operations with recovery. No echinococcus elements were found, although the pathological report showed echinococcus cyst wall, but no daughter cysts.

HYDATID CYSTS OF THE LIVER. Gallart Mones² discusses the question of the *diagnosis of hydatid cyst* by means of the deviation of the complement. His conclusions are as follows:

1. The reaction is positive in 69 per cent. of cases. Stern found 53 per cent. of cases were positive with serum which had not been rendered inactive. Weinberg had 53 suspected cases, in 25 of which he obtained a positive reaction which was confirmed by intervention, and in 16 cases the reaction was positive in those who had had cysts. Gallart Mones discusses the question as to the explanation of the 31 per cent., in whom the reaction was negative. He attempts to explain it:

- (a) The serum of the patient contained substances which inhibited the evidence of specific antibodies.

- (b) The fact that there is not sufficient antigen in the blood to provoke the formation of antibodies, the cyst toxin being enclosed until the time of rupture when reabsorption provokes the formation of antibodies inducing a positive reaction.

2. The specific antibodies disappear from the serum twenty-five to thirty days after operation.

3. The reaction of deviation is of absolute value, when positive,

¹ Long Island Medical Journal, 1916, vol. x, p. 317.

² Archiv. cl. mal. de l'app. Digestif et de la Nutrition, 1916, p. 148.

because it is specific. It must not be forgotten, however, that in 31 per cent. of cases it is negative.

4. There is no relation between eosinophilia and deviation of the complement—even with elevated eosinophilia antibodies may be absent.

5. With increasing doses of serum 0.1 to 0.5 c.c., and fixed doses of antigen 0.2 c.c., and with increasing doses of antigen 0.1 to 0.6 c.c., and fixed doses of serum, he got the same results.

DISEASES OF THE PANCREAS.

Reaction of the Pancreas and the Pancreatic Juice. The *Journal of the American Medical Association*¹ devotes an editorial to the researches of Long and Fenger² who demonstrated that the living pancreas of all animals, whether tested by indicators, by titration, or electrical conductivity, has an acid reaction. The acidity is practically constant, and does not vary with the seasons or the animals' diet.

I can do no better than give the text of this editorial which is extremely suggestive and worthy of thought: "Most of these tests were made on the pressed juice from the macerated organ, separated by the centrifuge: Applying this method to other organs, they found that the liver, spleen, and salivary glands usually give an acid reaction, but much less than the pancreas, while the pressed juice from the thyroid gland is neutral in reaction." They conclude that the "acid reaction of the pancreas is undoubtedly a normal one, and it has been overlooked because the outflow from the fistula (the pancreatic juice) is so plainly alkaline." In the first paper it is suggested that the "normal activity of the pancreas, the work of the cells results in sending an excess of alkaline phosphates to the intestines, while an excess of acid phosphates is retained to make the gland tissue slightly acid. This is a new conception of the mechanism of alkalinity of the pancreatic juice. It is known that the alkalinity of the normal pancreatic juice is about equal to 0.5 per cent. sodium carbonate, and it has been generally held that it is due to the excess of alkaline carbonates, the trace of phosphoric acid hitherto reported in the juice not being sufficient to account for the alkalinity on the basis of alkaline phosphates." In their second paper, the authors show by chemical (quantitative analyses) that the marked acid reaction of the pancreas is due to the presence of acid phosphates and acid nucleoproteins. But practically no evidence is adduced to show that the alkalinity of the pancreatic juice itself is due primarily to alkaline phosphates rather than carbonates. The reason advanced for the accumulation of acid phosphates in the gland itself in the course of normal activity remains, therefore, an interesting hypothesis.

Pancreatic Colic Due to Stone. Einhorn³ reports 2 cases of pancreatic stone which he has had under observation. The most characteristic diagnostic sign is the appearance of colicky pain in the epigastrium

¹ 1916, vol. lxxvii, No. 6, p. 438.

² *Journal of the American Chemical Society*, 1915, vol. xxxvii, p. 2213; *ibid.*, 1916, vol. xxxviii, p. 1114.

³ *Berl. klin. Wchnschr.*, 1916, vol. liii, p. 110; *abs.*, *Surgery, Gynecology and Obstetrics*.

associated with the transient appearance of sugar. This pain is periodically repeated, and its sudden cessation speaks for the passing of the stone. The appearance of a stone in the feces consisting chiefly of calcium carbonate without cholesterol or bile pigments points to its pancreatic origin.

Generally, pancreatic function is not disturbed for a long time, but, later on, there is generally evidence of diminution in pancreatic function. While the occasional appearance of sugar in the urine during an attack of colic is very important, it is not a *sine qua non* in the diagnosis of pancreatic stone.

If the ordinary attacks fail to be relieved by medical treatment, operative interference must be considered. The gall-bladder and the pancreas must be thoroughly examined. Frequently, according to this author, palpation of even small stones in the exposed pancreas is not possible. The gall-bladder should always be drained, because much drainage has a favorable effect upon an existing pancreatitis in the case of calculi.

DISEASES OF THE INTESTINES.

Colitis. An interesting study of *chronic colitis from an x-ray standpoint* is contributed by McMahon and Carman,¹ of Rochester, Minn. Their conclusions are rather original, inasmuch as *x-ray* evidence seems to make a differential diagnosis possible and indicates the severity of an old chronic colitis.

1. There is a group of subjective and objective symptoms which is quite characteristic of chronic colitis.

2. There are definite organic changes resulting from chronic colitis in all the coats of the colon wall, namely, chronic inflammatory reaction with edema, lymphocytic infiltration and thickening, scar-tissue formation and contraction.

3. X-ray examination in these cases shows the colon to be small, smooth and without haustration in the part or parts affected.

4. A more accurate estimation of the extent and severity of the involvement can be obtained by correlation of the clinical history with the *x-ray* findings.

5. The *x-rays* will frequently be of aid in determining the course of subsequent treatment.

6. In a limited number of cases they did not find chronic endamebic colitis to furnish any characteristic or similar *x-ray* finding. Therefore it appears to be of aid in differentiating amebic from chronic colitis.

Large Intestine. DIVERTICULITIS. William Mayo² reports a study of 42 patients with this condition. The signs and symptoms closely resemble those of appendiceal inflammation, with the marked difference that, in the great majority of instances, the disorder was on the left side of the abdomen. It is altogether probable that most of the reported cases of so-called "sigmoiditis" are examples of diverticulitis.

I shall try to use Mayo's words as much as possible, as the paper is

¹ Journal of Laboratory and Clinical Medicine, February, 1917, vol. ii, No. 5, p. 328.

² Journal of the American Medical Association, 1917, vol. lxi, No. 10, p. 781.

an unusually concise and clear exposition of the subject without recourse to the literature to any extent.

Of the 42 cases on whom resection was done, 66.6 per cent. were males and 33.4 per cent. females. The average age was fifty-three years. The youngest patient was twenty-seven years of age and the oldest seventy-three. The average weight was $173\frac{1}{2}$ pounds. The heaviest patient weighed 225 pounds, the lightest 120 pounds. The average duration of symptoms was two years; the longest twelve years; the shortest seven days. In 30 of the 42 patients, a sensitive tumor was present in the left iliac fossa during the attack, which was attended by localized peritonitis and often by intestinal obstruction. This group includes fleshy, middle-aged persons who present themselves with an acute sensitive tumefaction in the left iliac fossa. The mass gradually disappears in the course of some days with the restoration to health. The examination of the colon with the röntgen rays shows symptomless diverticula.

Diverticulitis and Peridiverticulitis with Formation of Abscess Resulting in Enterovesical, Enterocutaneous and other Fistulas. This group includes those cases in which infections—either a developing peritonitis with abscess formation or the results of infectious processes which connect the diseased colon with the cutaneous surface, the bladder or neighboring intestine—lead to the necessity of surgical interference.

Obstruction. In acute diverticulitis the obstruction is the result of infection and edema. Chronic obstruction is due to hyperplasia, adhesions and angulation—the hyperplastic stenosing type. The condition is practically identical with those in the first two groups, but the addition of the obstruction in these cases is so serious a feature that it seems best to classify them independently. It was most surprising, however, when the entire mass was dissected out and the diseased bowel laid open, to find so little actual obstruction. In this group a tumor is usually found, and in 31 per cent. malignant disease coexists. Mayo says, "I do not know of a more difficult differentiation than to foretell whether a given obstructing tumor deep in the iliac fossa of an adipose patient is diverticulitis or carcinoma, or both. Fortunately, the röntgen rays now furnish the differentiation in a higher percentage of cases."

Carcinoma Developing on a Diverticulum. This group is of great interest. Among the 42 cases of resection for diverticulitis, there were 13 in which carcinoma coexisted. The carcinoma had such definite relationship to the diverticulitis as to make it reasonable to assume that infection and irritation by hardened fecal masses in diverticula were the cause of chronic irritation, and precancerous change. The only known fact of importance in the etiology of carcinoma is its relation to chronic irritation. The term "precancer" is used to denote certain cell-changes taking place in the area of chronic irritation which, if found in connection with invasion of the tissues, would be typical of carcinoma. At the present time the diagnosis is made by the röntgen rays, since in carcinoma a filling defect will be found in addition to the less reliable findings of blood, pus, and mucus in the stool. With the sigmoidoscope

we have been able to differentiate carcinoma, associated with diverticulitis of the lower sigmoid and rectosigmoid, but have not been able to demonstrate diverticula.

"Of 42 patients with diverticulitis, with and without carcinoma, on whom we have performed resections, 14 per cent. died as the result of the operation; that is, within four weeks. The mortality was high, but it must be taken into consideration that these patients were adipose, and it was often necessary to operate during the stage of obstruction, infection, etc. When a primary resection was made, we employed an end-to-end union, but as a rule found it wise either to suture the anastomosed area well up into the peritoneum and leave the suture line exposed, or to pass a folded strip of rubber tissue entirely around the anastomosis to suspend it in the wound, as there is a tendency to late infections, and, unless provision was made for drainage, slowly progressing peritonitis occasionally caused death. To provide against gas pressure, we have sometimes passed a good-sized rubber tube by way of the rectum entirely through, and well above, the anastomosed area and fastened it with a single suture to the anus."

Intestinal Obstruction. Saraligin¹ says the diagnosis of intestinal obstruction is generally easy under the fluoroscopic screen. Whenever the author is sure of the permeability of the pylorus and that there is no lesion whatever that detains the ingesta in the stomach, he is convinced that there is an obstruction in the small intestine if, nine hours after a meal, remnants are still found in the stomach.

In chronic invagination of the small intestine, there is usually an absolute failure of the projection of the cecum on the screen. The projection of the shadow is different according to whether the obstruction is complete or not; in the first case we do not see the bismuth meal diminish in bulk when examinations are made at the end of twelve, twenty or thirty-six hours, and in the second we see the small intestine in its last part, displaying a thread of bismuth marking the reduced trajectory left by the invagination. In chronic or subacute appendicitis, there is frequently obstruction of the latter part of the ileum rendered visible at such times by intestinal ectasia.

When caseous or fibrocaceous peritoneal tuberculosis is a cause of intestinal obstruction, an ectasia of the bismuth is produced at the height where the constricting band or the bacillary process obstructs the lumen of the intestines. Clinically, it is usually the last portion of the ileum which is frequently the site of this lesion.

In obstruction due to Lane's kink, the diagnosis by the screen is based on the ectasia of the bismuth, with displacement of the cecum downward and to the right side.

When ectasis is produced at the level of the cecum, the diagnosis is not always easy, as there are other affections besides intestinal obstruction which are capable of showing the same symptomatology at this point (cecum mobile, etc.).

¹ Report of the Association of Medicine, Argentine, 1916, vol. iii, p. 86.

Study of Non-coagulable Nitrogen of the Blood in Intestinal Obstructions. Cooke, Rodenbaugh, and Whipple¹ contribute another article on this subject which is of interest. They point out that urea is not a reliable guide of the total nitrogen content of the blood serum, inasmuch as they found that urea varied from 30 per cent. to more than 80 per cent. of the total blood nitrogen, although, as a general rule, it was high in these cases. They were led in their studies by the belief that high non-coagulable nitrogen findings in the blood might prove of positive diagnostic value, high findings being an indication of a dangerous grade of intoxication, but they point out that a low reading may be associated with a fatal outcome.

They conclude that intestinal obstruction, as a rule, is associated with an increasing amount of non-coagulable nitrogen in the blood. In the acute condition, the rise may be rapid and reach as high as from three to ten times the normal amount. With more chronic conditions, there may be little or no rise. Acute proteose intoxication due to the injection of pure proteose will show a prompt rise in the blood of non-coagulable nitrogen. It may be even 100 per cent. in three or four hours. His cases show a high creatinin and urea content of the blood.

In one human case with autopsy findings, the results were exactly the same as in animal experiments. The kidneys in practically all these cases were normal. High readings mean grave intoxication.

They say that it is possible that tissue or protein destruction, rather than defective elimination, is responsible. Transfusions of dextrose often benefit these cases and depress the non-coagulable nitrogen level.

Colon Bacilli to Antagonize Pathogenic Organisms. Nissle² describes some very interesting studies on the intestinal flora. He noticed that when stools from different individuals were inoculated with typhoid bacilli, the organisms comported themselves very differently. On some specimens they grew luxuriously; on others, they failed to grow. This difference is explained by the difference in the power of the colon organisms present to combat the growth of the typhoid bacilli. He then isolated the colon bacilli from the different movements and compared their behavior to the typhoid organism. Tubes of bouillon were inoculated with a loop of the typhoid cultures and then incubated at 37° C. for seven hours, then inoculated with the colon bacillus and reincubated for fourteen hours. After this, Endo plates were made with the diluted mixture and on the following day 100 to 200 well isolated colonies were counted. The ratio between the typhoid and colon organisms is counted on the basis of 100 colon colonies. In this way he obtains what he calls the "antagonistic index." It shows the capacity of the individual colon strain to crowd out the typhoid bacillus. One strain may present an index of 100 to 500, another 100 to 200, the ratio of the "antagonistic power of these two strains would therefore be 1 to 25. The extremes found in his studies were 100 to 4050 and 100 to 3.

Studies of the colon cultures revealed, furthermore, that the strains

¹ Journal of Experimental Medicine, 1916, vol. xxiii, p. 717.

² Deutsch. med. Wehnschr., September 28, 1916, vol. xlii, No. 39, p. 1181.

producing the most lactic acid gave the highest index figures. When the index was high against the typhoid bacilli, the index was also high against other colon strains. The lowest index was found in 8 cases of chronic typhoid carriers. The highest index was found in some paratyphoid cases of exceptional mildness. The logical outcome of these experiments is their application to therapy, namely, giving individuals who have a low index colon strain, the colon organisms of high index. He gave the alien colon bacillus in capsules and reports 11 cases in which this treatment was systematically carried out. In 4, the intestinal flora was normal, and no benefit accrued, but in 7 cases of intestinal trouble due to the typhoid, paratyphoid, and streptococcus, the bowel flora returned to normal. This treatment seems to have proven its usefulness and seems to offer an efficient method of intestinal prophylaxis in those exposed to intestinal complaints.

Constipation and Intestinal Infection in Epileptics. Reed¹ contributes an interesting article on the question of intestinal infection and epilepsy. After careful consideration of all the facts in nearly 200 cases, he was forced to the conclusion that constipation had a great deal to do with epilepsy, and that the change was either due to bacterial activity or chemical changes in the intestines, or both. Drs. Hyatt and Forrer in his laboratory began to investigate this problem and they found an organism in the blood of epileptics which could not be found in the blood of non-epileptics. This organism injected into the blood of rabbits induced convulsions like those affecting the human subject and were furthermore recovered from the blood of the affected animals. After thorough consideration, he called this organism the *Bacillus epilepticus*. Since then, Hyatt and Forrer have recovered the organism in 168 out of 211 cases. This communication is mainly a defense of his position in the matter. Bra, some fifteen years ago, found an organism, injected it into animals, produced epilepsy, and recovered it; it is apparently this organism which Reed feels he has isolated in these cases and which is the cause of the disease. Although Hinkleman, Rehmy, and Noble have pointed out that it may be found in the alimentary tract of individuals who do not have epilepsy, nevertheless, according to Reed, it has never been found in the blood before, and he believes that through pathological conditions in the bowel there is enforced absorption.

Intestinal Toxemia. While Nissle insists on the value of the colon bacillus in regulating the intestinal flora, we find Satterlee² ascribing to the colon bacillus the predominating factor in the causation of intestinal toxemia. Putrefactive organisms, he says, may produce toxic effects, but the lasting effects are due to the colon bacillus. He further recommends, in the study and treatment of all long standing toxemias, autogenous colon vaccines prepared in proper doses. These act, according to Satterlee, by immunization and sensitization of the body cells. The colon bacillus has its habitat in the large bowel where it plays a part in digestion, and it elaborates material which exerts a marked inhibitory effect on the putrefactive organisms, principally the *Bacillus*

¹ Journal of the American Medical Association, 1916, vol. lxxvii, No. 16, p. 1157.

² Ibid., No. 29, p. 1729.

putrificus coli, in this way preventing intoxication (Satterlee). Carbohydrate oxidation and fat decomposition, fermentation, not putridity, are caused by the *Bacillus coli* action. Under normal conditions it lives a saprophytic existence and is not only harmless, but beneficial, to the host. When the colon is diseased, the colon bacillus is distinctly harmful either in the walls of the colon or when lodged in other parts of the body, as the peritoneum, genito-urinary or respiratory tract. It is then capable of becoming pyogenic, and its intracellular toxin is set free and can act in the body of its host. Vaughn says the bacterial cells must die to liberate the poison. Adami claims that, under ordinary conditions, the *Bacillus coli* is incapable of forming ectotoxins, but when the mucous membrane of the intestines is affected by traumatism within or without, the *B. coli* may wander and cause inflammation, liberating toxins. His method of making the vaccines is practically that of Türk.

Intestinal Venous Stasis. Türk¹ discusses the mechanism of intestinal venous stasis. After discussing the experiments on this subject, he says, "these factors just mentioned—stasis, fractional digestion, and the accumulation of fatty acids—lead to fatigue of the muscle cells, and the asphyxiation of these cells. As a result, we get atony of the muscle wall, permeability and diffusion of the bacteria and of the fractional protein products, and the bacteriolysis and proteolysis which these undergo in the *zona transformans* finally leads to anaphylactic reaction. In consequence of this reaction, we see further venous stasis from dilatation and fatigue of the walls of the intestines, with a simultaneous contraction of the arteries. Thus a vicious circle, more or less complete, is established, and we have what is clinically known as acidosis which may be either acute or chronic." Speaking of chronic cases, he says, "many children have two microorganisms present, often the *B. coli* and either the streptococcus or a staphylococcus in symbiosis. These are frequently found in the urine, having passed from the intestines, migrated through the tissues and escaped by way of the kidneys.

His method of preparing vaccines is as follows:

1. Make cultures from the feces. Isolate *B. coli* and other cocci usually in symbiosis.

2. Centrifuge the urine. Isolate *B. coli* and other cocci usually in symbiosis.

3. Centrifugalize the stomach contents, obtained from the morning fasting stomach. (Avoid clumps of mucus that appear to come from the mouth.) Isolate the *B. coli* and other cocci usually in symbiosis.

4. Combine these cultures. Secure the patient's serum. Spread over an agar slant and freely sow with the combined or mixed cultures. Cultivate thirty-six to forty-eight hours. Kill the culture in tricoresol, not by heat.

5. Sensitize the culture with the patient's serum. Prove the culture dead by incubation.

6. Count. Put in ampoules in graduated increasing doses, from 100,000,000 to 1,000,000,000.

¹ Boston Medical and Surgical Journal, 1917, vol. clxxvi, No. 19, p. 663.

These microorganisms, secured from the patient's urine and stomach contents, have thus been activated by the patient's own serum or secretions, and have acquired certain specific antibodies which render them valuable for vaccine purposes. In addition, growing the microorganisms cultivated in the patient's own serum *in vitro* permits an additional absorption to take place under conditions more nearly approaching those *in vivo*. Finally, by incubating the killed bacteria with the patient's serum, additional antibodies are taken up, making a most perfect vaccine, and one with a most potent effect.

Intestinal Stasis. Mosher,¹ in discussing intestinal stasis, outlines the following:

TREATMENT. Intestinal stasis patients need to eat and sleep by the clock as nearly as possible; use meat sparingly and drink plenty of water between meals. Little, if any, medicine is needed. Sometimes a digestive, a mild laxative, or a general tonic has to be given for a time. Russian oil or one of its substitutes should be taken without stint, for, since it is neither a medicine nor a food, it can be used without restriction. When bands or kinks are found, and, fortunately, these are present in not more than 10 per cent. of enteroptotic patients, the case becomes one for surgical consideration. Here the x-rays do their great work, giving more minute and accurate information regarding the conditions to be dealt with than can be otherwise gained.

Unhappily, as a profession, we are still in the twilight stage of operative treatment for the relief of chronic intestinal stasis. Lane, Bainbridge, Bloodgood, and others, are lighting the path, but their work, though brilliant, only makes clear the difficulties to be encountered, and a need for the skill that comes only through familiarity with the complex conditions so commonly found, and a knowledge of the best methods for dealing surgically with each.

Exercises to Aid Digestion, Prevent Constipation, and Strengthen the Abdominal Wall. 1. Lie on the back (bladder empty and knees bent). Gently stroke the abdomen downward six times along the inside of the left hip, from ribs to pelvis.

2. Stroke three times across the abdomen on the navel line from the top of the right hip to the top of the left, then downward as in Exercise 1.

3. Draw the lower abdomen forcibly inward by muscle contraction (not by breath) and imitate the movement involuntarily made in taking a long restful yawn—breathe in slowly all the air possible, stretching the trunk and neck upward, then as slowly breathe out all the air taken in. Repeat six to eight times. This exercise can also be taken in the sitting or standing posture and should be repeated often when enteroptosis is present.

4. Forcibly draw in the lower abdominal wall (not by breath but by muscle contraction) then raise it and hold long enough to count ten. Do this three times. Rest and repeat.

Note if the abdomen is distended by gas, insert a small tube (the rectal point of a syringe) into the rectum before beginning the exercises; if

¹ New Medical Journal, October 28, 1916, p. 846.

retained, it will let out the gas as fast as it is carried down. Never apply pressure below and to the inside of the right hip (region of the appendix).

These exercises should be taken by everyone on retiring, to overcome the sagging of abdominal organs due to the standing and sitting posture. They may be repeated half an hour or more before meals if indigestion and gas are present.

Lane's Kink and Band. Stein,¹ in discussing Lane's kink, reviews the ETIOLOGY of this condition. Lane claims that the origin of the condition lies in a cecum, which, distended from a number of causes, tends to prolapse. This descent is resisted by crystallization of lines of strain in the shape of peritoneal thickenings that later develop into independent bands. The outer bands extend from the outer aspect of the cecum upward to the lateral abdominal wall, the lowermost often involving the appendix, with formation of a kink. Other bands run along the under, or posterior, surface of the mesentery of the ileum. These bands are "evolutionary and functional" (Lane). Mayo has ascribed the bands to an inflammatory condition, but admits that a considerable number showed no evidence of inflammation in the band or neighboring appendix. Martin evidently considers the band of very little importance. He believes the kink occurs within the last four inches of the ileum because of its short mesentery at this point, being only one or two inches long. Acting on both ends of this comparatively fixed loop are two forces that tend to produce the angulation. They are (1) a large gut that is excessively movable or displaced; (2) an abnormal disposition of the small gut. Thus any condition that tends to produce defective nutrition and diminish intra-abdominal fat will allow a general viscerop-tosis. Defective development, as described under the article on pericolic membrane, will cause prolapsed intestines.

Flint states that in almost all the embryos in which he found a pericolic membrane he also found a peritoneal reflection from the posterior leaf of the mesentery of the ileum onto the parietal peritoneum near the brim of the pelvis. All these embryos, except two, showed a free mesentery of varying lengths. We are thus confronted with the question whether pericecal membrane and Lane's kink are not due to the same developmental factors, *i. e.*, migration, rotation and fusion of the ileocecal segment of the intestinal canal of the embryo. In fact, of the 11 adult cases of Lane's kink encountered by Flint, 5 also showed a cecal membrane. Three cases of Flint's indicate that irregularity in embryonic fusion of the ileum or its mesentery with the posterior parietal peritoneum is a potent factor in the development of the adult Lane's kink. Connell claims that delayed migration, with incomplete rotation, allows the ileum to be in contact with the peritoneum long enough for fusion to take place. Subsequent descent and rotation draw out this band of fusion. Excessive rotation, *i. e.*, beyond 180 degrees will produce a condition in which the ileum enters the cecum from before backward and is in apposition with the peritoneum at an abnormal

¹ Archives of Diagnosis, 1916, p. 116.

point. Reid has described a fetal band which he calls the genito-mesenteric fold, that runs from the mesentery of the terminal ileum into the pelvis to the genital gland. This genito-mesenteric band usually appears in conjunction with another fetal membrane known as the bloodless fold of Treves, which runs from the lateral parietal peritoneum across the cecum to be attached to the ileum and its mesentery, and might thus cause a kinking of the ileum.

Intestinal Bands and Adhesions. Ross and Mencke¹ also contribute an article on this subject, reviewing in a general way the material which was more fully covered in Stein's paper. They believe that practically all of these structures are the result of peritoneal inflammation of some kind; and, moreover, they are convinced that more extended clinical observation on the part of those who have had greater opportunities to theorize about, than to observe, these formations can only serve to make them agree with this opinion.

BANDS AND ADHESIONS IN THE CECAL REGION. Stein² discusses this question from several angles. The literature on this subject is so full of chaos that, in order to do justice to the problem, the views of many different observers must be given. Discussing the etiology of adhesions and bands in the cecal region, Stein says they may be either *congenital* or *acquired*.

Congenital. (a) Various observers have seen in the fetus what corresponds in the adult to so-called Jackson's membrane. This parietocolic fold was found by Jonesco, Eastman, Cheever, Reid, and others, and is accounted for by the changes which the cecum undergoes in development. It migrates from the left iliac region upward and across the abdomen to the hepatic region where rotation takes place, followed by descent to the right iliac region. The fixation normally takes place between the opposed surface of the cecum, ascending colon, and parietal peritoneum anteriorly to the right kidney. If fusion takes place before descent of the cecum, the later in its descent will pull the fine peritoneal bands down with it in an oblique direction. If fusion occurs before rotation is completed, the peritoneal fusion will occur between the anterior and internal aspect of the cecum or colon and the parietal peritoneum. Thus, as rotation progresses, the veil will be seen extending across the front and internal surface of the gut.

(b) Mayo has advanced the theory that the cecum, in its descent, burrows its way through the parietal peritoneum, which had been developed before the cecum began to descend. This explanation is rather difficult to understand inasmuch as it would appear that the whole cecum and ascending colon ought to be enveloped in, or at least covered by, a membrane, which is rarely the case.

Acquired. (a) The formation of the parietocolic membrane and also Lane's kink may be due to an attempt on the part of nature to overcome the effects of gravity. This theory, in general, can be discarded.

(b) Inflammatory colitis or repeated mild infections of the colon with resulting fermentation, putrefaction, and stasis in the bowel have been

¹ American Journal of the Medical Sciences, 1916, vol. cliii, p. 261.

² Archives of Diagnosis, 1916, vol. ix, p. 108.

considered the cause of pericecal and pericolic membranes. Binney, Gerster, and Pilcher entertain this view and believe that bacteria are capable of passing through the bowel wall even in the absence of ulceration. Pathological conditions of the duodenum, appendix, and gall-bladder have been held responsible for the development of the membrane by Hertzler and Hofmeister. Microscopic and pathological data fail to substantiate these ideas. Stein himself is of the opinion that the only explanation is that of atypical fusion between the cecum and colon and the parietal peritoneum or omentum. Pathological and histological studies show its resemblance to peritoneum, and emphasize the non-inflammatory character of the veil or bands.

Dysentery. ETIOLOGY. Martin and Williams¹ discuss the *etiology of dysentery from the stand-point of their bacteriological characteristics*. Attempts were made to isolate dysentery from 217 cases in which the stools contained mucopus. In many cases the amount of mucus was small.

B. dysenteriae Shiga was recovered on 47, and mannite-fermenting dysentery bacilli on 76, occasions. Ameba histolytica were present in 63 cases; in 36 no causative organism was found. The method employed was to wash the mucus, break it up in sterile broth, and plate out some drops on the surface of a MacConkey plate. The next day likely colonies were picked off, sown into warm broth, and incubated for a few hours. They were examined for motility, and, if motile, discarded. The non-motile broth cultures were sown into glucose, and mannite peptone water, and on an agar slope. If glucose, or both glucose and mannite, were fermented with the formation of acid only, an emulsion was made from the agar slope and tested as regards agglutination against a Shiga or Y-serum respectively. Macroscopic methods were employed.

The Shiga organisms were true to type; on the other hand, the mannite-fermenting group were very variable, and, from further sugar testing with many different carbohydrates, they came to the conclusion that the attempt to differentiate the mannite-fermenting dysentery group on the basis of their reaction to carbohydrates was unsound.

Value of agglutination in the identification of members of the mannite-fermenting group of dysentery bacilli. They used a number of different sera, those made of a member of each of Kruse's groups, A, D, and E, and of the univalent serums, Y-serum seems to be the least specific and covers the greatest range. From Morgan's work they say that the Y-serum seemed to be of the greatest aid in dysentery diagnosis in Egypt, but, in their work, in nearly one-sixth of the bacilli they recovered in 1916 were not agglutinated by the Y-serum directly after isolation. Their results are from the Australian General Base Hospital at Cairo.

Examination of the stools from 422 cases admitted to the No. 3 Australian General Hospital, Cairo, for dysentery and diarrhea, from March to August, 1916.

¹ British Medical Journal, April 1, 1917, p. 479.

Martin, Kellaway, and Williams (same article) report the following:

<i>Ameba histolytica</i>	72 cases
<i>Ameba coli</i>	29 "
<i>Lambliia intestinalis</i>	33 "
<i>Tetramitus mesnili</i>	14 "
<i>Trichomonas intestinalis</i>	16 "
<i>Coccidia</i> (isospores)	1 "

217 cases passing mucus with or without blood:

<i>Ameba histolytica</i>	63 cases
<i>Bacillus dysenteriae</i>	64 " (Flexner group)
<i>Bacillus indistinguishable from Flexner group</i>	12 "
<i>Bacillus dysenteriae</i>	47 " (Shiga)

There were no grounds for believing that any of the protozoological parasites present, except the *Ameba histolytica*, were responsible for ill health.

DYSENTERY AND DYSENTERIFORM DIARRHEA. Giroux¹ states that, of 150 cases of diarrhea treated by him, 40 were of the familiar type, 117 were examples of so-called dysenteriform diarrhea, while 3 were choleric form. But 5 cases ended fatally. In the dysenteriform column, convalescence was always announced by a urinary crisis—a profuse diuresis after a period of scanty urine. An associated phenomenon was bradycardia. In 3 patients the dysenteriform type was associated with paratyphoid. Both kinds of bacilli were present (dysentery, paratyphoid, B). In the other cases the *B. dysenteriae* could not be detected. The first case ended fatally.

In regard to the *treatment*, serum was given only when the dysentery bacillus was present or the clinical syndrome present. But this serum often seems defective in the most typical cases of dysentery. Under such circumstances we can only give *emetine*, which, generally speaking, gives prompt and good results. In other words, the dysentery is essentially amebic, with occasional coincidence of the *Bacillus dysenteriae*.

INTESTINAL CATARRH, TYPHOID, DYSENTERY, AND MIXED INFECTIONS. Arneth² gives the following as his treatment in cases of intestinal catarrh: An initial dose of castor oil is followed by 200 grams of bolus alba, mixed with sufficient boiled water. The diet should be restricted to weak tea and thick gruels, and water should be forbidden. After the first day, red wine is given, and two doses daily of a half-gram each of tannalbin. Benefit is also derived from the application of an abdominal binder for warmth. In cases without fever, 3 doses of tincture of opium should be given daily with the treatment just outlined. In typhoid and dysentery, the initial dose of castor oil should be omitted, but the rest of the treatment is just the same. In bacillary dysentery, small doses of a mixed Flexner and Shiga antiserum should be given as early as possible. Tannigen is twice as strong as tannalbin, and is decidedly preferable to the latter in dysentery, and either is to

¹ Presse médicale, September 14, 1916.

² Berl. klin. Wehnschr.; abs., New York Medical Journal, 1916, vol. civ, part 2, p. 566.

be preferred to bolus alba for controlling the movements. Additions to the diet should be made slowly in cases of dysentery, for rapid increase is often followed by relapses. No addition should be made to the diet until the stools become more or less formed. When using the antiserum, an initial dose of 20 mils. is given, and this, or even double the quantity, is repeated every day or two.

AMEBIC DYSENTERY. Bates,¹ in discussing the question of the treatment of amebic dysentery, says that one of the most important factors in the treatment of this condition is rest. The patient is put to bed and given a saline purge or castor oil. He is kept in bed until all acute symptoms have subsided. After the purgative has acted, emetine or ipecac is begun. He then increases the dose to 1 grain a day and continues until all amebas are cleared from the stool, as shown by microscopic examination. This will usually require a total of from 5 to 6 grains of emetine. If it is not controlled by microscopic examination, 6 grains should be given. At the time emetine is discontinued, bismuth subnitrate is given in large dose. Bismuth acts in two ways: first, as a sedative on the intestinal tract and as an aid toward the healing of the ulcers present; secondly, as was pointed out by Deeks, bismuth itself acts as an amebicide and is an added help in destroying such amebas as may be left over after the discontinuation of the emetine or those formed from the "encysted" stage. Bismuth is usually given in 1-dram doses every four hours. It will be then reduced to 1 dram three times a day until the patient is discharged as well.

Enemas of normal salt solution, two or three quarts at a time, are given as soon as the effect of the purgative has subsided. They are used every four hours during waking hours and continued in this way until the administration of ipecac or emetine is discontinued. Remember that in flushing the colon, a short tube should be used in order to avoid ulcer of the bowel. Sweet milk is the best food in amebic dysentery. Later on, soft-boiled eggs and dry toast are added to the diet.

Riviere and Villerva² describes a **SUPRARENAL FORM OF DYSENTERY** which developed in paroxysms—associated with unmistakable evidence of suprarenal trouble—extreme weakness, very low blood-pressure, and dermatographism. The ameba apparently produces a toxin which acts upon the suprarenals. Emetine should be given early, and, in these forms, epinephrin exhibited.

Matter³ describes an *intestinal condition secondary to a severe kidney disturbance among the troops*. Among 620 soldiers admitted to his service, 61 were of this group aside from 25 with complete renal insufficiency and 25 from true dysentery and albuminuria. Some ran an acutely fatal course; in all, the somnolent aspect was evident from the beginning. When blood-urea remained high, sickness kept up. Bacteriology of blood was negative, but the stools frequently showed ameba and dysentery bacillus. Four-fifths of the cases showed an infectious condition more or less recently. He explains the whole trouble due to

¹ Journal of the American Medical Association, 1916, vol. lxvii, No. 5, p. 345.

² Paris médicale, April 2, 1917, vol. vii, No. 16, p. 310.

³ Ibid., March 17, 1917, No. 11, p. 214.

intense overwork, sleeplessness, and errors in diet, with lessened resistance of the bowels and intestinal infection. The previously damaged kidneys suffer from absorption of intestinal toxins, nitrogen accumulates, and the vicious cycle is kept up. Treatment directed toward the kidneys is of the greatest benefit.

Colonic Dilatation. Alexander, Arnett, and Magoun¹ are of the opinion that until the causes of chronic intestinal stasis are better understood, the operation of simple ileocolostomy should be abandoned, for the same cause which produced the indication for operation will also cause its failure. There is obviously no use in operating on a colon to rest it by a short-circuiting operation when the entire wall has been damaged beyond recovery. This is one more reason for giving up simple ileocolostomy. The operation should be abandoned until the cause of intestinal stasis and the pathology which it produces are thoroughly understood.

The Vermiform Appendix. Fowler² gives what is in many respects the best resumé of the anatomy, physiology, etiology, diagnosis and therapy of APPENDICITIS, including a thorough summary of the literature.

In discussing the physiology, he reminds us of the fact that Heile pointed out that the walls of the appendix secrete tryptic and amylolytic ferments, and that there is also an internal secretion of hormones which stimulates peristalsis when injected into rabbits. Waller and Cole, from skiagraphic observations, were convinced that the appendix was a specialized part of the cecum with a definite peristaltic and sphincteric action, and that fecal material, normally retained in the appendix from one period to another, provides bacteria for colonic digestion; in brief, that the appendix is a physiological "culture tube."

Concerning the question of diagnosis, Fowler reviews the whole subject, and a brief resumé of this phase of appendicitis is as follows: Randall claims that many cases of appendicitis are overlooked in the absence of right rectus rigidity. Tenhorn believes that traction on the right spermatic cord produces pain in appendicitis which he believes is due to irritation of the peritoneum about the internal ring. He doubts the value of the cremasteric reflex sign.

Ruthkevitch believes that palpation is of the most value, and his method is as follows: The flexed fingers of the right hand are pressed down between the external wall of the cecum and the abdominal wall. The fingers are then extended and an endeavor made to deflect the cecum toward the middle line. This manipulation invariably produces pain in chronic appendicitis.

Bischoff distends the previously emptied bowel with air through a rectal tube. By this means pain is elicited over McBurney's point (Bastedo sign).

Lanz states that frequent and painful urination in children may be an early sign of appendicitis. When the finger is introduced into the right inguinal canal, the muscles contract about it if the appendix is inflamed. The cord is painful and tender. Contrary to Tenhorn,

¹ Surgery, Gynecology and Obstetrics, Chicago, April, 1917, vol. xxiv, No. 4.

² *Ibid.*, 1916, vol. xxiii, p. 1.

Lanz believes that the cremasteric reflex is weak or absent in acute appendicitis.

Sutton believes that sharp, shooting pain in the vulva is an indication of an adhesion to the posterior wall of the bladder. It is explained by the fact that the vulva and bladder are supplied in part by the sacral plexus.

Regarding *röntgenoscopic evidence*, Eisen considers that a normal appendicular lumen does not rule out appendicitis. He considers the most valuable symptom to be pain from direct pressure right over the appendix, or when making traction or displacing it. Imboden states that the probable reason why the normal appendix is not visualized is because it fills and empties between observations. Failure in filling may also be due to: (1) Obliteration of its lumen; (2) adhesions or kinks near the proximal end; (3) an acute attack with infiltration of the mucosa; (4) the lumen may be obstructed by a fecolith or filled with contents not bearing opaque material; (5) it may be retrocecal, in which event the cecum is partially empty, the stereoröntgenogram usually reveals it. He concludes that: (1) Retention of the appendiceal contents after the cecum is empty should be regarded as suggestive of chronic appendicitis. (2) A tender area located in the course of the appendix should be regarded as suspicious. (3) The Trendelenburg position affords an unexcelled opportunity to study this area. Stereoröntgenography affords the increased amount of information usual to this method in general.

In response to the following questions: (1) What is the significance of barium retention in the appendix? (2) What is the significance of inability to demonstrate the appendix by means of the röntgen rays? (3) What are the röntgen signs of appendicitis? Personal communications were received as follows:

Dr. James T. Case: "Barium in the appendix is an abnormal phenomenon. It by no means indicates surgery. If, by accurate palpation of the barium-filled appendix, we are able to determine adhesions, kinking, irregularities of the lumen, poor drainage (two or three days or longer) then we have surgical indications. The poorer the drainage, the greater the danger.

"Inability to demonstrate the appendix by means of the röntgen rays depends upon: First, obstruction of the lumen by an obliterating appendicitis, by turgescence of the tissues attending a recent inflammation, or kinking or adhesions near the base of the appendix. Second, the appendix may fill, but lie so definitely retrocecal, closely adherent to the cecum, that it cannot be seen. Also great local tenderness or rigidity of the abdominal muscles may prevent accurate manipulation. Nevertheless, when the appendix remains filled longer than the cecum, we can demonstrate it. Third, failure to use the fluoroscope. Not once in 50 times is the appendix seen in the ordinary röntgenogram. Not even simple fluoroscopic observations will suffice. One must manipulate with the hands or with the wooden spoon or both. In acute appendicitis manipulation is unwise, but a barium enema will often identify tenderness on pressure as being over the appendix. I

have discovered several cases of left-sided appendicitis in this manner. As to the röntgen signs of appendicitis: (a) In acute appendicitis no signs are needed, except the barium enema, as above noted. (b) The röntgen signs of a chronic conditions are: (1) poor drainage; (2) localized tenderness on accurate palpation done under fluorescent screen guidance; (3) kinking; (4) irregularities in the lumen so that the appendix is bulbous at the tip, and especially poorly drained at the tip; (5) associated adhesions to the cecum and terminal ileum; (6) unduly long or unduly large appendix. All these signs need not be present. The diagnosis should not be based upon röntgen findings alone."

Dr. G. E. Pfahler: "Barium retained in the appendix after the bowel is entirely empty probably indicates a relaxed or inflamed appendix. Inability to demonstrate the appendix by means of the röntgen rays may mean that the appendix is obliterated or that it is filled with some other material and will not permit the barium to enter it. The röntgen signs of appendicitis are localized tenderness over the appendix, fixation, angulation, constrictions, local dilatations, adhesions about the cecum, incompetent ileocecal valve and undue retention."

McWilliams suggests the difficulty of diagnosis in cases of chronic appendicitis in which local pain and tenderness are mild or absent. These cases are characterized by distant reflex disturbances. He classifies them as follows: (1) Pain type, characterized by colic in children, simulating gastric or duodenal ulcer, or gall-stones; this class includes cases of pylorospasm. (2) Nausea type. (3) Vomiting type. (4) Gas type, characterized by toxemia producing anemia; chronic constipation, chronic diarrhea and colitis. (5) Bilious or toxic type with headache. (6) Neurasthenic type. Medical treatment is of no avail. He warns against the use of such terms as nervous indigestion, neurasthenia, gastralgia, intestinal toxemia, and bilious headaches as indicating a functional disturbance unless an organic basis can be ruled out absolutely.

Morley calls attention to the frequent errors in the diagnosis of chronic appendicitis, particularly, that type in which there has never been acute attacks, and which is characterized by chronic pain and some tenderness, usually accompanied by constipation. He considers Lane's kink to be a practically symptomless congenital band. Jackson's pericolic membrane, also of congenital origin, may sometimes produce symptoms simulating chronic appendicitis, but more often these symptoms are due to the "mobile proximal colon" associated with it. Morley believes that chronic inflammation of the right adnexa is the commonest cause of erroneous diagnosis. Often a precise preoperative diagnosis is impossible.

Kenefick believes that spasm of involuntary muscles may be caused by local irritation in chronic appendicitis. He cites 3 cases, 1 of false angina without subjective symptoms of appendicitis, the second, esophageal spasm during deglutition with a negative history of appendicitis. Diagnosis of appendicitis was made by eliciting sharp pain on deep pressure over the appendix and by röntgenograms.

"The irritation or traction spasm originates at some particular

attachment of the appendix to a branch of the mesenteric plexus and reaches the musculature of the stomach by way of the mesenteric and celiac plexus as follows: (1) Hepatic plexus gastroduodenalis to the pylorus; (2) plexus gastro-epiploica dextra to the pylorus and lesser curvature; (3) plexus gastroduodenalis to the fundus and region of greater curvature. Afferent impulses in general pass from an inflamed appendix to the mesenteric ganglia, suprarenal ganglia, vagus to medulla and cortex independent of the spinal centers."

Gage states that pain, tenderness, and muscular spasm in the right iliac region occur during typhoid and render differentiation from appendicitis difficult. The difficulties are increased by the fact that the appendix does share in the intestinal lesions of typhoid fever, as shown by instances of ruptured typhoid ulcer of the appendix. Gage divides the appendicitis of typhoid fever into three groups: (1) Appendicitis, an accidental accompaniment of typhoid fever; (2) typhoid ulceration of the appendix; (3) appendicitis occurring so soon after typhoid fever as to be possibly due to it.

This article by Fowler is from every angle the most careful resumé of appendicitis that we have come across.

Arthritis Deformans and Intestinal Infection. Silver¹ says that the accumulating evidence regarding the *etiology of arthritis deformans* points to some focal infection, especially of the mucous membrane of the gastro-intestinal tract. He says, "It seems to have been demonstrated that the active agent in arthritis deformans may enter through the intestinal tract. This active agent is undoubtedly bacterial, probably most commonly streptococci and the intestinal mucosa is to be regarded as one of the number of mucous membranes through which infection may enter the system. Through the production of stasis and probably also through its influence on the glandular secretions, viscerop-tosis is likewise of importance in the production of intestinal infection, and so favors systemic invasion. In an individual with lessened joint resistance, it may be the deciding factor in the development of arthritis." How frequently arthritis develops in arthritic subjects and what is the proportion between the number of cases of arthritis due to this cause and those arising from other intestinal infections cannot now be stated.

Volvulus. Powers² believes that there are two necessary factors in the production of volvulus: (1) A congenital or acquired defect in the intestinal attachment, (2) a condition producing an artificial pedicle. In other words, it is necessary to have a loop of loose bowel, lying less securely supported than is usually the case, a loaded bowel and irregular peristalsis. Usually there is a long mesentery and one or more turns in the loop upon itself.

The onset is sudden, acute, and often in the midst of apparent health while the signs of the obstruction depend on the position of the volvulus. When the sigmoid is affected, the signs appear early; when the cecum is involved, there may be a delay until the large intestine has

¹ American Journal of Orthopedic Surgery, 1916, vol. xiv, p. 513.

² American Journal of Surgery, 1916, vol. xxx, p. 178.

emptied itself or there may be a discharge of flatus from the bowel which masks it. Temperature and pulse are not altered at first. At first abdominal distention is limited to the portion of the bowel involved, and there is no rigidity of the muscle walls of the abdomen; local tenderness is marked, but not prominent until the onset of peritonitis.

Strangulated hernia, acute perforation of the stomach or the duodenum, biliary and renal colic, acute intestinal obstruction due to strangulations with bands, hemorrhagic pancreatitis, thrombosis and embolism of the mesenteric vessels, and appendicitis must all be considered in the diagnosis.

The prognosis is unfavorable. In 25 cases, 14 men and 11 women, 21 of these patients died.

In the after-treatment nothing should be given by mouth for twelve hours. Three or four doses of pituitary extract, 0.5 to 1 c.c., may be given hourly into the muscles to stimulate involuntary muscular contraction, while if distention is great, the rectal tube should be passed.

DISEASES OF THE KIDNEYS.

By J. HAROLD AUSTIN, M.D.

Renal Physiology. Motzfeldt¹ reports some experimental studies on the *relation of the pituitary body to renal function*. He attributes the variation in the results of previous observers chiefly to unsuitable methods. He finds that a standard curve of polyuria may be plotted for rabbits that have been given 200 c.c. of water by mouth. The extracts of the pars intermedia and posterior lobes of the hypophysis given by mouth, subcutaneously or intravenously, are able definitely to check the polyuria thus induced. Extracts of the anterior lobe show a similar effect, but only to a slight degree. This antidiuretic effect is constant, and is independent of changes in blood-pressure, intestinal absorption, and the vagi. The effect is apparently prevented or delayed by division of the splanchnics, and is diminished by division of the renal nerves near the hilus.

A similar antidiuretic property is possessed by B-imidazolyethylamine, by P-oxyphenylethylamine, by a preparation from *Secale cornutum*, by small doses of nicotine, by large doses of caffeine, and by extracts of the adrenal cortex.

No effect on the polyuria is produced by strychnine, morphine, adrenalin, or by extracts of thyroid, thymus, pineal, pancreas or corpus luteum.

The antidiuretic effect of the hypophysis is absent or only slightly marked in checking the so-called salt diuresis. The effect of the pituitary substances seems to be caused by a stimulation of the sympathetic nervous system, and the renal vasomotor system is of chief importance in this respect. Clinically, these conceptions bring the polyurias related to disorders of the nervous system and the polyurias of pituitary origin into closer relation.

In an experimental study on adrenalectomized cats, E. K. Marshall, Jr., and D. M. Davis² have found evidence of the existence of an *interrelationship of the adrenals and kidneys*. Following adrenalectomy there is a rise of blood urea to about twice its normal value, where it remains approximately stationary until shortly before death, when it rises again. The phenolsulphonaphthalein excretion shows a tendency to diminish. Cats with both adrenals removed excrete much less urea and creatinin in their urine after an injection of these substances than normal or singly adrenalectomized animals. The kidneys of the adrenalectomized animals show no noticeable histological change from the

¹ Journal of Experimental Medicine, 1917, xxv, 153.

² The Influence of the Adrenals on the Kidneys, Journal of Pharmaceutical and Experimental Therapy, 1916, viii, 525.

normal, but those of adrenalectomized animals which have received an injection of urea, creatinin or sodium chloride show a striking change consisting of extensive fat deposits in the epithelium of the convoluted tubules. The nitrogen retention in the blood is associated with a diminished nitrogen excretion in the urine so that there is no evidence of marked change in the protein catabolism. These evidences of lowered kidney efficiency in the adrenalectomized animals may occur with a normal blood-pressure and when the animals are in excellent physical condition. Marshall and Davis believe that the secretion of some substance by the adrenals which is necessary for the maintenance of normal kidney function is the probable explanation of their results.

During attempts to measure the rate of blood flow through the kidney, Addis and Shevky¹ noted that the concentration of urea may be higher in the renal vein than in the renal artery. This occurred when, as a result of manipulating the kidney, the flow of urine ceased, apparently as a result of vasoconstriction. This additional urea found in the renal vein must have had its origin, they believe, in some accumulation of urea within the kidney. It is well known that the kidney contains more urea than the other organs of the body; this in part is due to concentration of urea within certain of the kidney cells, and in part to its concentration in the urine in the renal tubules.

Cushing² has demonstrated that section of the cervical cord with its associated fall in blood-pressure leads to a cessation of urine flow and to a diminution in the urea content of the kidney. Thus closely paralleling the findings of Addis and Shevky.

In a recent monograph on the secretion of the urine, Cushny³ presents a most interesting review of the *theories of renal excretion*, and proceeds to outline the one which appeals to him as having the weight of evidence in its favor. This theory, which is a modification of Ludwig's, he calls the modern theory.

Briefly, it is as follows: The secretion of urine consists of two distinct processes differing not only in site but also in nature. The first of these, the filtration, occurs in the glomerulus, and is purely physical; the second, the absorption occurs in the tubules, and depends on the vital activity of the epithelium.

He further adduces evidence to show that the constituents of the urine fall into two groups: One, a group that is relatively readily reabsorbed through the tubules, including water, chlorides and sugar; and the other a group that is reabsorbed with difficulty, including urea, pigment, phosphates and sulphates. The urinary composition with respect to a given constituent, such as urea, is not, according to this theory, determined simply by the urea concentration of the blood and the amount of urine being excreted, as postulated in Ambard's laws, but is influenced by the concentrations of all the urinary constituents and their respective effects upon reabsorption in the tubules. A formula that would express the relation between blood and urine accord-

¹ American Journal of Physiology, 1917, xliii, 363.

² Journal of Physiology, 1917, li, 36.

³ The Secretion of the Urine, Longmans, Green & Co., 1917.

ing to this theory would have to contain values not for one constituent alone but for many, or all, of the urinary constituents. Data for the construction of so complex a formula are, of course, as yet unavailable.

Experimental Nephritis. Karsner¹ has found that, during the second and third days of experimental tartrate nephritis in dogs, the vascular reactions of the kidney, as tested by Schlayer's and Hedinger's method, are practically normal except that caffeine does not produce a diuretic effect equal to that seen in normal dogs. In the fifth day of the tartrate nephritis, the vascular reactions are somewhat more marked than normal, and the diuretic effect of caffeine is equal to that seen in normal animals. The study has shown no additional reasons for believing that the appearance of albuminous precipitate in the subcapsular space indicates an alteration in the functional capacity of the glomerulus nor has the converse been proven. The kidneys, studied histologically, of 4 out of 17 animals show the presence of albuminous precipitate in the subcapsular space. It is possible, in at least some of the other animals whose vascular reactions were investigated, that this material had been present but washed out by diuresis. The depressor substance of dogs' urine is not caused to disappear by tartrate nephritis, although it may be somewhat reduced either in quantity or in activity.

Bailey² has shown that there may be produced in the rabbit, by the intravenous injection of large doses of diphtheria toxin, a vascular degeneration involving the entire aorta, the carotids to the base of the skull, the subclavians and iliaes, and, for a varying distance distally, the brachials, femorals, and large abdominal vessels. The first part of the pulmonary artery is sometimes affected. The lesion is practically diffuse throughout the aorta and vessels mentioned, consisting of a fatty degeneration and necrosis of the smooth muscle in a wide zone of the media, and a crowding together of the elastic fibers in the origin affected, resulting in an irregular thinning of the vessel walls and many small aneurysmal pouchings. In rabbits which received pituitrin with the diphtheria toxin, extensive calcification occurred throughout the degenerated zone, both in the aorta and in other large vessels. He believes, however, that the pituitrin is not essential to this calcification, and that if the pituitrin is of any importance in this connection, it is because an extensive fatty degeneration is produced more quickly in the media of the vessels when pituitrin is administered simultaneously with the toxin.

Diphtheria toxin, given in large doses intravenously, produces a pronounced vascular and parenchymatous degeneration in the kidneys of the rabbit. The former consists of a swelling and desquamation of the endothelial cells of the arterioles and small veins, with the formation of fibrinous thrombi, a necrosis and thrombosis of the capillaries of the tufts with hemorrhage and the formation of fibrinous and hyaline masses, and, in some of the affected glomeruli, a considerable collection of polymorphonuclear leukocytes.

¹ Journal of Pharmaceutical and Experimental Therapy, 1916-17, ix, 483.

² Journal of Experimental Medicine, 1917, xxv, 109.

Faber¹ injected diphtheria toxin of known strength intravenously into rabbits in single doses and found that this produced renal lesions which are first evident in the endothelium of the tufts and possibly in the intertubular capillaries, giving rise to the intracapillary glomerulonephritis of Volhard and Fahr. When, with the toxin, sublethal inoculation of *B. coli* or intravenous injections of Vaughan's split protein *B. coli* are given, the rabbits develop a severe glomerulonephritis corresponding to the extracapillary form of Volhard and Fahr. Evidence is presented to show that the epithelial damage in the tufts, and especially in the tubules, following larger doses of the diphtheria toxin alone, is secondary to the vascular injury.

In experimental uranium nephritis in the dog, Goto² demonstrated the existence of an acidosis by the use of the Van Slyke method for plasma bicarbonate, and also, but less satisfactorily, by Marriott's method. This acidosis was associated with an increase in the blood urea and in the plasma chlorides, and with the appearance of albumin and casts in the urine. By the administration of sodium bicarbonate by the stomach-tube, a reduction was secured in the acidosis, the plasma chlorides, the albumin and the casts of the urine, and, to a lesser degree, in the blood urea. In animals that had received soda, moreover, the morphological change in the kidneys was less severe and pronounced. This study confirms that of MacNider upon the action of alkalis in reducing the severity of a uranium nephritis and adds data concerning the plasma bicarbonates and chlorides in this condition.

Renal Functional Tests. Mosenthal and Lewis³ have made a comparative study, in a series of clinical cases, of five of the renal functional tests. The tests compared were: The phenolsulphonephthalein test, the total non-protein blood nitrogen, the blood urea, Ambard's coefficient of urea excretion and the renal test meal of Mosenthal.

Phenolsulphonephthalein and Ambard's coefficient were of equal value in showing the degree of impairment of renal function. The test meal for renal function often indicated a greater degree of depression of function than did the other tests. In the early diagnosis of impaired renal function, the tests, in order of their positive appearance, were: The test meal, phenolsulphonephthalein, Ambard's constant, the urea nitrogen of the blood. A maximal involvement was most frequently seen in the test meal, less frequently in the phenolsulphonephthalein test and least often in Ambard's coefficient.

"The relationship between tests of renal function and prognosis in nephritis has been found to be very uncertain. The extrarenal factors, cerebral hemorrhage, myocardial insufficiency, intercurrent infections, etc., have caused a fatal termination so frequently as to put a greater emphasis on the physician's clinical judgment than on the interpretation of tests for renal function alone. In certain patients, degrees of impaired kidney activity are found which are ordinarily considered incompatible with life. These, as well as others who exhibit uremia

¹ Journal of Experimental Medicine, 1917, xxvi, 139, 153.

² Ibid., xxv, 693.

³ Journal of the American Medical Association, 1916, lxxvii, 633.

with apparently fair functional kidney processes, go far to show that uremia and renal lesions are not entirely dependent one on the other."

"A high non-protein nitrogen (above 90 mg.) or a high urea-nitrogen (65 mgm. or above) has been found to be the most reliable prognostic sign."

The authors give the following table showing, in accordance with their studies, the degree of impairment of renal function as indicated by the tests employed.

Degree of impairment of renal function.		Phenol-sulphone-phthalein, per cent.	Non-protein N. of blood, mg. per 100 c.c.	Urea N. of the blood, mg. per 100 c.c.	Ambard's coefficient of urea excretion.	Test meal for renal function.					
						Night urine		Variations in sp. gr. when highest sp. gr. is:			
						C.c.	Sp. gr.	18	17-15	14-13	12-
Normal	0	60+	30-	15-	0.90-	400-	18+	9+			
Slight	+	59-40	31-45	16-27	0.910-0.115	401-600	16-17	8-5	6+		
Moderate	++	39-25	46-65	28-44	0.116-0.220	601+	15-	4-	5-4	6+	
Marked	+++	24-11	66-90	45-64	0.221-0.350			3-	5-4	6+	
Maximal	++++	10-0	91+	65+	0.351+				3-	5-	6+

Such a graduation of the tests indicates the relative degree of renal involvement as shown by each. Inasmuch as each of them has an individual significance apart from the others, comparison according to this method is an extremely valuable aid in the treatment and prognosis of diseases of the kidney.

The level of the non-protein and urea nitrogen of the blood must be considered largely as the resultant of three factors—kidney efficiency, diet, and protein destruction. In judging of prognosis, when these substances are high in the blood of nephritics, due regard must be given as to whether their accumulation is brought about by retention alone or through retention coupled with increased protein destruction. The former offers a comparatively better prognosis than the latter. The coefficient of Ambard is, in the experience of these authors, a better method of determining the ability of the kidney to excrete urea than the level of this substance in the blood.

The progress of renal disease is probably followed most minutely, they believe, by means of the phenolsulphonephthalein test and Ambard's coefficient, as these tests furnish figures in which small variations are of significance. The writers of this chapter would urge caution, however, in connection with this last conclusion because of the wide variations that may occur in the phthalein test as the result of changes in the degree of renal passive congestion and because of the wide variations that occur normally in the Ambard coefficient in non-nephritic individuals.

Christian¹ has confirmed and extended Mosenthal's² observation of impaired renal function in pernicious anemia, as determined by the

¹ Archives of Internal Medicine, 1916, xviii, 429.

² Ibid., 1915, xvi, 733; Proceedings of the American Medical Association, June, 1916.

renal test diet. The test diet of Hedinger and Schlayer¹ was used, the patient being placed on a special regimen so arranged that different meals, given throughout the day, had varying amounts of fluids, sodium chloride, protein and purin bases. There was estimated the amount of urine, its specific gravity, the chloride and nitrogen content, both total and percentage concentration in two-hour specimens collected throughout the day and in a single night specimen. Normally, the factors so determined vary according to their relation to the meals, and the charted results form an irregular, or "picket-fence," curve. In nephritis, these curves are flattened toward straight lines according to the nature and severity of the renal involvement.

Twenty-one observations were made in 14 cases of pernicious anemia, none of which, save one, showed symptoms or physical findings of a chronic nephritis. Renal function was found disturbed in these severe anemias in much the same way as in chronic nephritis. This disturbance in excretion is probably the result of the anemia, either a toxic or a nutritional disturbance in renal cellular activity, rather than the result of an actual renal lesion. Improvement in renal function with improvement of the blood condition supports this view. Conversely, the author points out that in a case with moderate nephritis with considerable anemia this latter factor might give a picture of renal excretion as judged by the renal test diet suggestive of severe nephritis and thus lead to an unjustifiably poor prognosis. Chace and Myers,² in a discussion of the value of the recent laboratory tests in the diagnosis and treatment of nephritis, conclude that: "An increase in the uric acid of the blood would appear to be of considerable value as an early diagnostic sign of incipient nephritis. The urea of the blood has been found very valuable as a guide to the treatment of moderately severe cases of nephritis, since any change in the patient's condition is quickly perceptible.

"As a prognostic test, the blood creatinin has been found of very great service, over 5 mgm. per 100 c.c. having invariably proved fatal after the lapse of a comparatively short period of time. During the terminal stages of the disease the concentration of the creatinin gradually rises, reaching 15 to 30 mgm. in most cases at death.

"The determination of the carbon dioxide combining power of the blood plasma, according to the method of Van Slyke, is a valuable index of the acidosis of nephritis from the view-point of both diagnosis and treatment.

"In cases of advanced diabetes complicated with nephritis, glycosuria, or absence of glycosuria, is a very poor guide to the hyperglycemia, since the nephritis has lowered the permeability of the kidney for sugar. In these cases the estimation of the sugar of the urine should always be supplemented by the determination of the sugar of the blood."

An excellent summary of the effects of nephritis upon the nitrogenous substances of the blood is given by Karsner³ and there is included a bibliography of the subject.

¹ Deutsch. Arch. f. klin. Med., 1914, cxiv, 120.

² Journal of the American Medical Association, 1916, lxxvii, 929.

³ Journal of Laboratory of Clinical Medicine, 1916, i, 910.

As an index of renal function in some experimental studies on rabbits, Addis and Watanabe¹ have collected urine and blood simultaneously and determined the ratio:

$$\frac{\text{Gm. of urea in 1 hr. urine.}}{\text{Gm. of urea in 100 c.c. of blood.}}$$

Precisely the same objection can be urged against such a ratio as has already been urged by one of us against the quotient of Ambard and Weill; namely, that unless such a mathematical expression is actually the correct expression of a physiological law, its use as a measure of deviation from the normal is likely to be misleading. Neither for Ambard and Weill's quotient, nor for this ratio of Addis and Watanabe, has conclusive proof of its physiological accuracy been presented.

Addis and Watanabe² have made further studies on the effect of changes in blood-urea concentration on the rate of urea excretion. A curve has been constructed by them which indicates the average effect of changes in the blood-urea concentrations on the rate of urea excretion in man.

The wide variation of individual observations from the average curve (a variation of 200 per cent. at a blood-urea concentration of 0.03 per cent. and of 75 per cent. at a blood-urea concentration of 0.09 per cent.) shows that other factors than the blood urea have a pronounced effect on the rate of urea excretion. There is a relative decrease in the percentile variation from the average curve as the blood-urea concentration rises (although the absolute variation is about the same). The authors interpret this as meaning that the greater the stimulus to increased work in excreting urea, the less subject the kidney becomes to influences tending toward variability in its rate of work. It is perhaps worthy of note, in passing, that the curve of Addis and Watanabe does not obey Ambard's first law upon which the Ambard and Weill coefficient is based.

"The variability in the rate of urea excretion at every level of blood-urea concentration during the short periods of time (15 to 120 minutes) chosen in these experiments is in marked contrast to the uniformity in the rate of excretion of administered urea over periods of eight to twenty-four hours. This is taken as indicating that unknown factors lead to short-lived variations in the rate of excretion, and that these variations tend to counter-balance one another over longer periods."

The degree of variation from the average curve in one individual is as great as in the whole group. This makes untenable the hypothesis that permanent individual peculiarities, such as might arise from anatomical differences in kidney structure, are responsible for the variations.

Their³ further found that changes in the volume of urine or in the urea concentration of the urine do not necessarily have an appreciable effect on the rate of urea excretion; when no food or water have been

¹ *Journal of Biological Chemistry*, 1916, 1917, xxviii, 251.

² *Ibid.*, 1917, xxix, 391.

³ *Ibid.*, p. 399.

taken for some time (about 18 hours), the drinking of large quantities of water is followed by an increase in urine volume and by a synchronous acceleration of the rate of urea excretion which cannot be accounted for on the basis of changes in blood-urea concentration. But there is no evidence that this increased rate is a result of the increased volume of urine, for the degree of increase above the normal in the rate is quantitatively independent of the degree of increase in volume.

McLean,¹ in a further investigation of the mechanism of urea retention in nephritis, presents a detailed study of 2 cases of chronic nephritis with a consideration of the interrelationship between nitrogen intake, blood-urea concentration and nitrogen output, and shows that changes in the separate factors may occur while no change in the actual ability of the kidneys to excrete urea is demonstrable, confirming, the author believes, the value of the McLean index based on Ambard's laws for the estimation of renal functional capacity. The author emphasizes, however, the tendency to wide fluctuation of the index between the extremes of 80 and 200. In certain abnormal individuals (in the 4 cases quoted in the paper, they are cardiac, arteriosclerotic or chronic interstitial nephritic cases) not this tendency to fluctuation in the index, but extreme constancy, or fixation, is the rule. "These individuals are to be regarded, as the result of this study, as probably abnormal, but the pathological significance of the fixation has not been determined."

McLean admits that Ambard's laws give only what he terms a relatively constant quotient in normal individuals and that an actually constant quotient is indeed a sign of abnormality. "The cause and significance of fluctuation" in the quotient in normal cases, he says, "is difficult to determine. It may depend either upon the influence of variable factors not determined as yet, and therefore not included in the formula, or on the fact that the ascertainable values now included in the formula do not hold that relation to each other, which the laws imply." "The latter interpretation," McLean continues, "we hold to be inadmissible because there is a sufficient degree of constancy, even under conditions where fluctuation occurs, to furnish strong evidence of the validity of the laws. In certain abnormal conditions where fixation has been shown to occur, the striking degree of constancy obtained must be interpreted as adding greatly to this evidence already furnished by the degree of constancy obtained in normal individuals."

With McLean's conclusion concerning the validity of Ambard's laws, the present writers cannot wholly agree.

Using the microrefractometric method of Robertson by which, on a small amount of blood, serum albumin, serum globulin and total non-proteins can be estimated, Rowe² concludes as follows:

In chronic nephritis with edema, the total serum proteins are reduced to the lowest values obtained in disease, the albumin being more reduced than the globulin. This is probably due partly to hydremia, partly to chronic intoxication. The non-proteins are increased.

¹ Journal of Experimental Medicine, 1917, xxvi, 181.

² Archives of Internal Medicine, 1917, xix, 354.

In chronic nephritis with anemia, the total proteins are usually normal or a little above normal, probably due to dehydration. The non-proteins are extremely high.

Chronic nephritis without edema or uremia shows a slight depression of the total proteins with a decided increase in the percentage of globulin. There is a moderate increase in the non-proteins.

Cardiac decompensation with, or without, edema shows a decrease of total protein, but not to the extent found in chronic nephritis with edema. The globulin percentage is somewhat above normal. The non-proteins are moderately above normal.

In arteriosclerosis, the average results show normal total proteins. The globulin percentage is moderately increased. The non-proteins are moderately increased.

Diabetics showed normal total proteins, except in two severe cases in which they were low. The globulin percentage was normal except in the presence of a complicating infection when it rose. Non-proteins showed a slight increase.

In pernicious anemia the total proteins are low, but not so low as in chronic nephritis with edema. The globulin percentage and the non-proteins are normal, as also in secondary anemia due to cancer and Banti's disease, but they are increased in the secondary anemia of infections and nephritis.

Hyperthyroidism, goitre (colloid), hemophilia, chronic bronchitis, pellagra, obesity, lead-poisoning, chronic gastro-intestinal disease and neurasthenia gave normal results.

Myers and Killian,¹ by an application of the method of Lewis and Benedict for analysis of blood-sugar, have made studies of the diastolic activity of the blood in 6 normal cases, 13 diabetics, 23 nephritics and 34 miscellaneous cases. They found a marked increase in the diastatic activity of the blood in all the diabetics and in 11 of the nephritics. They suggest that this may be an important factor in inducing the hyperglycemia of these conditions. The increased diastatic activity of the blood in nephritis is probably to be explained, they believe, by the now well-known decreased excretion of diastase in the urine in this condition.

Uremia. Foster² believes there are three distinct and basic types of what is called uremia. Clinically, we see only exceptionally these types uncomplicated, just as we see only exceptionally pure types of renal disease.

The first type is that due to a simple retention of urinary nitrogenous waste, a urinary poisoning. In the state of complete anuria, whether induced by impacted renal calculus, or by the removal of the only kidney, or by such poisons as mercuric chloride, the symptoms resultant are in all cases almost identical. "It is well known that in such cases there are few or none of those symptoms which demark our conception of spontaneous uremia. Convulsive seizures, for example, are not observed. Nervous phenomena are conspicuously wanting.

¹ Journal of Biological Chemistry, 1917, xxix, 179.

² Journal of the American Medical Association, 1916, lxvii, 927.

gastro-intestinal disturbances absent or appear only as moribund manifestations." "The essential positive symptoms are progressive asthenia and anorexia; later stupor and death." In one case of complete anuria due to the removal of the sole functioning kidney (the other being atrophic and infantile), immediately after death, nine days after the operation, a liter of blood was secured, which showed 126 mgm. of total non-protein nitrogen per 100 c.c. of blood, but none of the crystalline substance which Foster has isolated from cases of convulsive uremia.

A rather close resemblance to the picture of urinary poisoning is produced when, to advanced chronic nephritis of the hypertensive variety, there is added the complicating factor of cardiac dilatation and insufficiency. To the stupor, asthenia and anorexia, there is added, in such a case, sometimes a mild delirium or mental clouding, and edema may or may not be marked. Symptoms indicating irritation in the motor centers are not observed when this type is pure.

The second type of so-called uremia occurs associated with defective water and salt metabolism, resulting in cerebral edema. It is occasionally seen complicating the large white kidney, although such cases do not, as a rule, progress to uremia, usually developing some terminal infection. Exceptionally, however, during the last period of life, some uremic symptoms are in evidence, such as vomiting, headache, stupor, amaurosis due to edema of the retina, and, finally, coma. Foster has never seen convulsive seizures in such cases. The blood-pressure remains normal or subnormal. The blood and tissue analyses do not indicate any notable degree of nitrogen retention, even when corrected for the water excess. At necropsy, aside from the nephritis, the conspicuous condition is edema, and this is peculiarly notable in the brain and meninges. To this latter, Foster is inclined to attribute the cerebral symptoms. The cerebrospinal fluid in these cases is frequently under increased pressure, and, after some fluid is removed, there is a temporary clearing up of the mental state.

The third type is convulsive uremia, and is due, Foster believes, to a toxemia, resulting from an abnormal catabolism. It is from such cases that he has isolated his highly toxic crystalline substance which kills a guinea-pig with convulsions or muscular twitchings and coma. This substance is not, Foster believes, a normal excretory product, but is a product of abnormal metabolism, a result of perverted processes instituted perhaps by renal disease.

Chace¹ notes that "*gastric symptoms* are among the common early symptoms of nephritis. In cases with obscure gastric disturbances, the chemical examination of the blood has been found very valuable." Several cases were observed "in which the estimation of the blood creatinin not only showed that the patients were suffering from severe nephritis, but gave a fatal prognosis. In some of the earlier cases the blood uric acid was of value as an early diagnostic sign." In most of the cases the plthalein test and the blood urea indicated the diagnosis and severity of the case.

¹ American Journal of the Medical Sciences, 1917, cliii, 801.

Acidosis. It is a generally recognized fact that acidosis may occur in the course of nephritis, particularly in the terminal stages, as evidenced by diminished carbon dioxide tension of the alveolar air and carbon dioxide combining power of the plasma, an increased hydrogen-ion concentration of the blood or serum, a diminution of the alkali reserve, and of the oxygen combining power of the hemoglobin.

Marriott and Howland¹ point out that this acidosis does not depend on an accumulation of the acetone bodies, for they do not appear in the urine nor are they increased in the blood. Lactic acid is likewise not sufficiently increased in the blood to account for the acidosis. An explanation suggested by a number of writers is that the kidney fails to play its part in excreting the acid substances ordinarily formed.

The regulation of the acid-base equilibrium of the body is largely maintained by the ability of the kidney to excrete acid phosphate. In order to prove the failure of this function of the kidney, it is necessary to demonstrate an accumulation of inorganic phosphates in the blood serum. In a series of cases of acidosis occurring in nephritis, Marriott and Howland were able to show an increase in the phosphorus of the serum in every case to many times the normal amount, that is, from 8 to 23 mg. per 100 c.c. of blood. Simultaneous determinations of the combined carbon dioxide of the serum showed that, in certain instances, the phosphoric acid was combined with twice as much of the available base as was the carbonic acid, in striking contrast to the normal conditions in which the base combined with phosphoric acid is only from one-tenth to one-fifteenth of that combined with carbonic acid. The retention of acid phosphate, the authors conclude, would seem to be sufficient to account for the degree of acidosis observed.

Means and Rogers² describe a series of observations on the various factors of acidosis in a case with bilateral cystic kidneys and terminal uremia associated with severe dyspnea. The patient was a colored male, aged forty-six years. The case was interesting in that it presented one of the most intense acidosis ever reported in uremia. The alveolar carbon dioxide tension two days before death was 6.4 mm. Hg. The carbon dioxide capacity of the plasma, determined by the method of Van Slyke, ranged from 12 vols. per cent. two days before death and before the administration of alkali up to 37 vols. per cent. on the day of death following the administration of considerable sodium bicarbonate. The hyperpnea was extraordinary, with a ventilation ten times the normal resting value. That this was in large part due to the acidosis seems probable because of the distinct improvement in the respiration secured by giving alkali. However, although the acidosis was diminished by giving alkali, as proved by the rise in the plasma carbon dioxide capacity, the patient's general condition grew progressively worse. "That the acidosis was one of retention rather than of production is suggested by low renal function tests and the low index of urea excretion, together with high phosphates and non-protein nitrogen of the blood, and the autopsy finding of almost total absence

¹ Archives of Internal Medicine, 1916, xviii, 708.

² American Journal of the Medical Sciences, 1917, cliii, 420.

of normal renal tissue." The case exhibited a very high alkali tolerance, but, unlike the cases of chronic glomerular nephritis studied by Palmer, the acid ammonia ration of the urine was normal, indicating an ability to utilize ammonia for the neutralization of acid. The total acid and ammonia excretion was not increased. "The clinical picture was similar to that commonly found in bilateral cystic disease of the kidneys. Pain and digestive symptoms are common at the onset. Edema is rare. Terminal uremia is usual. The urine is usually increased in amount, with little or no albumin, low gravity and no casts. The blood-pressure of 10 shows no elevation."

Nephritis. ETIOLOGY. Dick and Dick¹ have made a study of the bacteriology of the urine in a series of 18 patients with focal infections, such as tonsillitis, bronchitis, and rhinitis. Cases of primary infection of the urinary tract, of syphilis, cases with pus in the urine, infections known to be accompanied by septicemia, such as pneumonia, and cases of active tuberculosis were excluded.

Cultures from the focus of infection were made aërobically and anaërobically on human blood-agar slants. Shake cultures of the urine were made in plain agar with 2 c.c. of catheterized urine; 15 c.c. of urine were centrifuged, and aërobic and anaërobic cultures on human blood agar were made from the sediment.

Of the 18 cases, in 6 the bacteria when found in the urine did not correspond to those found in the focus of infection studied; in 4, a partial correspondence was found; in 8 cases the correspondence was striking. In these cases the organisms found were streptococcus, pneumococcus, a streptothrix, and certain unidentified fusiform and anaërobic bacilli. In 2 of these 8 patients, there was no clinical evidence of a renal lesion. One of these, however, had persistently high blood-pressure (150 mm.). In the remaining 6, there were from mild to severe renal lesions present, but there was no constant relation between the severity of the lesion and the number of bacteria in the urine.

"The finding of considerable numbers of bacteria in the urine in 66 per cent. of patients with evident foci of infection indicates," the authors believe, "that in diseases where migration of bacteria from foci of infection takes place, the bacteria are often present in the urine."

Hanzlik and Karsner² found that the administration of salicylate, in doses corresponding to full therapeutic doses for human beings per kilo of body weight, causes the appearance of albumin, casts or cast-like bodies, and sometimes red corpuscles in the urine of animals. A preëxisting albuminuria is aggravated by the administration of salicylate. There is likewise a diminution in renal functional efficiency, as determined by the non-protein and urea-nitrogen of the blood.

As to morphological changes, the lesions vary from slight cloudy swelling of the tubular epithelium to severe cloudy swelling, associated in a few instances with distinct glomerular lesions. The latter, when present, are only very mild and do not warrant a diagnosis of acute glomerular nephritis.

¹ Archives of Internal Medicine, 1917, xix, 493.

² Ibid., p. 1016.

Hanzlik and Scott¹ made further observations on the albuminuria and renal functional changes following the administration of full therapeutic doses of salicylates in normal, rheumatic, non-rheumatic febrile and afebrile persons. They conclude that the albuminuria is not of febrile origin, but due directly to the drug. A preëxisting albuminuria is aggravated by the administration of salicylates. Renal functional efficiency is diminished, as evidenced by lessened water secretion, diminished phenolsulphonephthalein excretion and accumulation of urea nitrogen in the blood. The administration of bicarbonate, together with the salicylate, has practically no demonstrable influence on the albuminuria and renal functional changes produced by the salicylates.

Colp² has studied the effect of anesthesia and operation on kidney function, as shown by the phenolsulphonephthalein test and urinalysis, his observations embracing a series of 55 cases.

The average case, thirty-six hours after operation, showed very little change as demonstrated by the phthalein test, although 25 per cent. showed urinary changes, which in ten days' time were again negative.

The functional activity of the kidney was depressed as the length of anesthesia was increased, while in short anesthetics, the kidney may even appear to be stimulated to a slight degree. As age increases, the kidney becomes more susceptible to the deleterious influences. In nervous patients, anemic, obese and arteriosclerotic patients, the effects of anesthesia are more marked. Cases with preëxisting albuminuria or a decreased phthalein excretion show effects of kidney depression, but these effects are only temporary. In long anesthetics and in nervous patients, gas and oxygen anesthesia have the least disturbing effect on kidney function.

PATHOLOGY. Ten patients with nephritis have been studied by Aub and Du Bois³ in the calorimeter. In edematous patients, a reduction in the basal metabolism was almost uniformly noted. Edematous nephritics kept on low diets showed a reduction in food requirement similar to that usually found in prolonged undernutrition. Other nephritics possessed approximately the normal food requirement.

"From a study of 93 cases of nephritis in children between the ages of two and twelve years," Berkley and Lee⁴ conclude that "the blood-pressure is elevated in the nephritis of childhood and occasionally to a marked degree. This applies both to acute and chronic nephritis. Systolic and diastolic pressures are not increased to the same degree, the former averaging about 20 mm., and the latter about 10 mm. above normal. The pulse-pressure is increased. The blood-pressure in chronic nephritis shows no constant elevation above that of acute nephritis. No relation has been found to exist between the blood-pressure and the urinary findings. Patients having marked edema showed a slightly higher blood-pressure, as a rule, than those with little or none. Albuminuric retinitis was observed in 2 cases, the only ones

¹ Archives of Internal Medicine, 1917, xix, 1029; see also Journal of the American Medical Association, 1916, lxxvii, 1838.

² American Journal of the Medical Sciences, 1917, cliii, 868.

³ Archives of Internal Medicine, 1917, xix, 865.

⁴ American Journal of Diseases of Children, 1917, xiii, 354.

with systolic pressure over 200 mm. No statement is made as to how many of the other cases were examined for this condition. The figures of Judson and Nicholson¹ are accepted by the authors as the normal blood-pressure for the various ages.

TRENCH NEPHRITIS. Amenille and MacLeod² were much impressed with the frequency of spontaneous acute nephritis among the soldiers in the trenches. To investigate the causes of this susceptibility, they examined the urine from those still apparently healthy. Albuminuria was found in 1.87 per cent. of 1175 infantry soldiers in an active sector, and 1.31 per cent. in 686 in a sector quiet at the time. Among 2229 British troops from two to eight days after serving their turn in the trenches, there were 4.73 per cent. unmistakable cases of albuminuria, and 3.53 per cent. among 311 still in the trenches. 2.91 per cent. of 2069 English hospital attendants presented albuminuria, and 10.12 per cent. of 553 new recruits after six months of military training in England. Among 231 attendants at the French base hospitals less than 1 per cent. had albuminuria. Reëxamination a week or so later showed that, in men under 30, the albuminuria was transient, subsiding as the men rested. In older men it seemed to be a warning of impending or already installed nephritis. Blood-pressure observations showed no tendency on the part of trench life to a deleterious influence on arterial tension.

Urine collected from 10 men in the French trenches averaged 1200 c.c., with 12.35 gm. of urea and 9.41 gm. chlorides. Parallel examination of the urine from 15 men in the English trenches showed a daily average of 1830 c.c., with 45 gm. urea and 10.34 gm. chlorides. Control examinations of soldiers not in the trenches showed the same high figures for the British as compared with the French, all averaging 50 per cent. above the French soldiers. This indicates an habitually higher protein regimen in the British dietary, and the authors are inclined to attribute to this the higher incidence of albuminuria among the British troops as compared with the French.

Ameuille³ emphasizes that the acute nephritis of the trenches may be of two types, nephritis with anasarca or nephritis with azotemia. The uremic form may set in with jaundice, meningeal symptoms, delirium and convulsions, with fever, more or less albuminuria, but no edema. At other times, the disease may begin with infectious sore throat, acute enteritis or generalized ecthyma. The temperature runs up more rapidly than in typhoid, and the fluctuations are more pronounced, grippe or febrile stomach trouble being the diagnosis frequently made. The urine is scanty, with much albumin, more or less blood and up to 2 gm. of urea or more per liter. If the urea in the urine subsides as the content in the blood increases, a fatal outcome is inevitable.

The disease runs its course in two weeks on an average, but the range is from death or recovery in a few days to a very protracted course.

¹ American Journal of the Diseases of Children, 1914, viii, 257.

² Bull. de l'Acad. de méd., Paris, 1916, lxxvi, 103.

³ Presse méd., Paris, 1916, xxiv, 489.

Considerable weakness afterward is the rule, but recovery seems to be complete at last. In 2 cases there was acute azotemia, but no fever and no albuminuria.

The lesions in the kidneys differ from the classic lesions of acute nephritis. They seem to be nodular lesions from acute interstitial inflammation, scattered through a kidney with traces of old, but very slight, chronic changes. Recent inflammatory lesions of much less extent and severity are found at times in some of the other organs, indicating that a general infection is acting on abnormally frail kidneys.

This acute nephritis of troops, the so-called trench nephritis, is defined by Tremolières and Caussade¹ as follows: An acute or subacute nephritis, of more or less sudden onset, running a more or less definite clinical course, occurring in healthy soldiers at the front in whom no antecedent condition, no symptoms of recognizable acute infection (scarlet fever, typhoid, varicella, erysipelas, etc.) or chronic infection (tuberculosis, syphilis) and no evidence of arteriosclerosis can be discovered.

Etiology. The most evident etiological factor appears to be the strain of all sorts which war imposes on soldiers, including the physical and mental stress, the poor alimentary hygiene, the long sojourn at the front, and successive wounds. The condition is more prone to occur in the cold and wet months from October to May. No known micro-organism can be incriminated. One of the authors made numerous blood and urine cultures in the field, with no result. Further studies at the base hospitals do not support a bacterial hypothesis.

Initial Phase. In two-thirds of the cases it is an acute nephritis of sudden or rapid onset, with fever, headache, lassitude, edema amounting often to anasarca, oliguria, albuminuria of from 2 to 15 gm., and hematuria. Toward the close of the third week, the symptoms subside and the cases can be evacuated to the rear. In one-third of the cases the soldiers remain up, suffering with headache, fatigue and lumbar pain, and the surgeon, noting the puffiness of the eyelids, examines the urine and finding it loaded with albumin sends them to the rear. After a brief rest in the hospital, the symptoms subside, but a moderate albuminuria persists.

Later Stages. At the subsidence of the acute stage of a well-marked case, there is present slight edema, marked anemia, diminishing albuminuria, normal urinary output or polyuria, sometimes functional cardiac murmurs, and occasionally a barely palpable liver. Brief recurrences with slight fever and elevation of blood-pressure and return of edema are common. Sometimes repeated or persistent hematuria occurs. Headache and lumbar pain may continue. The mild cases (34 per cent.) with little else than albuminuria show normal renal functional tests (indigocarmine, chloride elimination and blood urea). Of this 34 per cent., 10 per cent. became completely cured. The other 24 per cent. exhibited an intermittent albuminuria, which is little or not at all increased by the rigors of military life. A few cases, however,

¹ Ann. de méd., 1917, iv, 73.

exhibit a permanent albuminuria in spite of normal functional test and this is promptly exaggerated on resuming the hardships of the service.

The cases evacuated after well-marked acute nephritis (66 per cent.) exhibit more evidence of persistent trouble. Two types are observed. About 44 per cent. show an increased permeability for indigocarmine, but a more or less marked chloride retention and edema, and more or less hematuria. These cases may, in several months, pass into cases of simple albuminuria or they may become chronic. The second type (14 per cent.), observed usually in those past thirty, show little albuminuria, but a tendency to cramps, dead fingers, etc. In addition to chloride retention, there is more or less azotemia in these cases, with reduction of indigocarmine elimination. The azotemia responds well in these cases to low protein feeding, and, after a fortnight of such regime, rarely recurs. These cases, provided they show no cardiac hypertrophy or hypertension, can after a time resume their military life. Some observers, but not the authors, have seen these cases proceed to chronic azotemic nephritis.

The remaining 7 per cent. of all cases advance in the first few months to permanent chronic nephritis. This may follow the mildest types of onset as well as the severe. Cardiac hypertrophy and hypertension are the best signs of such development. These cases may occasionally advance rapidly to fatal termination in a few months, with subacute uremia, pericarditis, eclamptic uremia or pulmonary edema.

Effects of Ureteral Obstruction. Beer¹ points out that extrinsic causes (usually obstructive in character) may lead to permanent symmetrical renal damage, evidenced by minimal or zero excretion of phthalein or indigocarmine, and associated usually with high blood urea and high incoagulable blood-nitrogen content. Operation in these cases will be of no permanent benefit, and even the slightest surgical interference (in one case the passing of a cystoscope) may bring on a fatal uremia. Similar extrinsic causes may lead to temporary renal damage evidenced by the same phenomena. In such cases relief of the obstruction, either by use of the indwelling catheter, or by regular catheterization, or by preliminary cystostomy, under local anesthesia or gas, will lead to an improved renal output. A low combined output may be caused reflexly (inhibitive or toxic) by more or less extensive disease of one kidney, while the other kidney is in good condition and improves in its function after removal of its diseased mate or after relief of the pathological condition in the same.

Braasch and Mann² studied the *effects of retention in the kidney of media employed in pyelography*. It has been recognized that pyelography is not without danger. Deaths have been reported by various observers that were the result of overdistention of the renal pelvis. More recently there have been reported cases of hydronephrosis removed at operation in which necrosis of the renal cortex was evident, although the pelvis had not been overdistended. Sections showed numerous deposits of the colloidal silver. The avenues of introduction of such

¹ Annals of Surgery, 1916, lxiv, 434.

² American Journal of the Medical Sciences, 1916, clii, 336.

metallic deposits have not been definitely determined; a possible route is by means of lymphatic and vascular absorption. The writers also suggest that in case of occlusion of the natural drainage of the pelvis, peristaltic contraction may force the pelvic contents into the tubules.

Experiments were carried on in a series of dogs, using various substances to inject into the ureters, and studying the kidneys removed subsequently. Mild chemical irritants, such as sodium chloride and boracic acid, when injected and retained in the pelvis of the kidney did not produce any lesions of that organ. The effect of methylene blue was practically negligible. More stringent chemical irritants, as sodium citrate and 20 per cent. thorium nitrate, when tested in the same manner, produced lesions of the kidney, which seemed directly due to the chemical injected, and not to any concomitant or subsequent infection.

Argyrol, collargol and cargentos were about equally responsible for producing the most marked changes noted. It was often possible to find areas in which the metal could be distinguished. Nor did weaker solutions of colloidal silver appear to be less harmful than the more concentrated. Silver iodide preparations produced less change in the kidney than the other silver solutions. As far as could be determined, thorium nitrate (15 per cent. solution) did not produce changes in the kidney except possibly in one experiment. The authors caution that the solution in its preparation be thoroughly neutralized.

Harpster¹ reports a case of *spontaneous exclusion of the kidney* from the urogenital system as a result of obstruction of the ureter and pelvis by *multiple calculi*.

At operation, the left kidney was removed. The ureter was found occluded. The parenchyma of the kidney was almost entirely destroyed; the cavity was filled with a caseous mass. Calculi, as shown in the x-ray, were found. There were no tubercle bacilli found on examination.

Although this process of healing or exclusion of the kidney, or, as it has been termed "autonephrectomy," has been frequently noted as occurring in tuberculosis, it is not so well known that a similar lesion may be the result of ureteral lithiasis when the ureter has become obstructed for a long time. In the large majority of cases there results an infectious lesion, with resulting pyonephrosis.

Cabot and Crabtree² discuss the *etiology and pathology of non-tuberculous renal infections*. While a satisfactory comprehension of the diseases of the genito-urinary tract depends upon a clear appreciation of the nature and probable course of renal infection, there is no subject on which there is so little uniformity of opinion, and so much confusion.

That bacteria circulating in the blood may be excreted by the kidney without producing gross lesions has long been known. In 1896, Biedl and Kraus showed that the *Staphylococcus aureus*, the *Bacillus coli* and the anthrax bacillus passed through the healthy kidney. The same fact has been demonstrated for the typhoid bacillus, the tubercle bacillus and others. On the other hand, the excretion through the kidney of

¹ Surgery, Gynecology and Obstetrics, 1916, xxiii, 375.

² Ibid., p. 495.

bacteria may be attended by lesions mild or severe. Kowitz, studying a group of children with infectious diarrhea, found in some cases that blood culture showed the *Bacillus coli*. Promptly thereafter there appeared in the urine first albumin, then bacteria, and finally pus. That the colon bacillus can be obtained from the blood in cases of acute pyelonephritis with considerable frequency has been shown by Crabtree, who, in a series of 32 cases, obtained positive blood cultures in 40 per cent.

The theory that infections reach the kidney by direct extension from the lower urinary passages has been widely held.

"It has been customary to assume that in this method of renal infection the bacteria reached the kidney by one of three ways:

"1. By continuity from a bladder infection by direct extension of the process within the lumen of the ureter.

"2. By the transportation of the bacteria in a column of urine which is supposed to exist within the ureter. By this conception the bacteria float upward, apparently also by their own motive power in disregard of the descending stream of urine and ureteral peristalsis.

"3. By reverse peristalsis within the ureter. This, of course, presupposes obstruction of the ureter, since, so far as we know, there is no warrant for the assumption of reverse peristalsis in the absence of obstruction. . . . The whole theory of ascending infection rests primarily upon the proposition that infection of the bladder takes place under a great variety of conditions unassociated either with trauma or with retention, for unless a preëxisting cystitis is assumed, the whole proposition falls to the ground as applied to the great majority of the cases."

Melchior and Rovsing have shown that, experimentally, cystitis could not be produced in animals without retention or trauma; that with retention of urine, experimentally produced, there generally resulted no pyelitis. Bauereisen, working with the tubercle bacillus, concluded that a bladder with intact mucosa cannot be infected; with the flow of urine unhindered, tubercle bacilli cannot reach the kidney through the ureter; obstruction of the urinary stream will, as a rule, result in urogenous ascending infection of the kidney, the latter conclusion implying a dilatation of the ureter and an incompetent ureterovesical valve. Draper and Braasch, in attempting to produce ascending renal infections, wholly failed to do so except by maintaining an abnormal amount of pressure in the bladder over a long time. Experimental work thus fails to support the assumption of ascending infection by means of the urinary passages.

The writers state that they do not believe that ascending infection from the lower to the upper urinary tract must be wholly discarded, for there are two conditions under which it is theoretically possible and practically probable, namely, ureteral obstruction due to stone, inflammatory stricture, or abnormal constriction of the lower end of the ureter by hypertrophy of the bladder, such as is seen in tuberculosis and obstructive conditions at, or below, the neck of the bladder. The second condition is incompetence of the ureterovesical sphincter.

The pyelitis of pregnancy and that of childhood have been the chief supports of the theory of ascending infection. The short urethra and the comparative ease with which the region of the urinary meatus might be contaminated with the colon bacillus, and the fact that, in the adult female, vesical irritability is often the first symptom, are the two important arguments. The writers claim that it has not been shown, however, that the cystitis antedates the pyelitis. The fact that this disease occurs more frequently in the female, whether adult or child, is important, but its significance has been misunderstood.

"In the adult female there can be no doubt that the conditions normally existing in the large intestine are more favorable to the occurrence of bacillemia than in the male. There is, as yet, no adequate explanation of the greater frequency of these infections in the female child, but we think that existing evidence points to the view that this explanation will be found, not in the anatomical peculiarities of the female urethra, but in the anatomical peculiarities of the female intestine."

Attention has been called from time to time to the possibility that bacteria might reach the kidneys by way of the lymphatics. Mascagni showed that the lymphatics of the upper ureter drained into the lymphatics in the region of the kidney pelvis and that organisms might reach the kidney along these channels. He also showed that the lymphatics of the lower ureter drained into the lymph nodes of the anatomical pelvis. Sakota further showed that the system of lymphatics of the lower ureter and bladder are connected by an intermediate chain of lymphatics embracing the central portion of the ureter. This chain is not continuous, but is, on the contrary, highly interrupted. Organisms, in order to extend from bladder to kidney by this route, would have to pass through several systems of lymph nodes, a contingency that decreases the probability of such occurrence. Upon these anatomical observations have been based the theory of lymphogenous infection.

Now, in general, the lymphatic currents throughout the body follow the flow of blood in the bloodvessels. Unless one disregards this doctrine, it is difficult to trace lymphatic processes over areas totally lacking in continuous vascular channels. The blood supply of the ureter is distinctly segmental. Furthermore, assuming the probable fact that organisms reach the lymphatics about the bladder and over the lower segment of the ureter, the probability of their reaching the blood stream, rather than continuing in devious lymphatic channels, seems overwhelming. "Reasoning from lesions produced by lymphatic infections elsewhere in the body, progress by this method is comparatively slow, and, on account of the interrupting lymph nodes, is more likely to produce highly localized lesions than lesions spreading rapidly over long distances and flooding a distant area with organisms."

Following the work of Brewer, it has been almost universally admitted that the staphylococcus infections of the kidney are of hematogenous origin. These infections have been shown to be associated with furunculosis, carbuncle, and various septic foci. On the other hand, the infec-

tions of the kidney with the colon bacillus, of which the purest types are the pyelonephritis of infancy and of pregnancy, have been regarded as ascending infection, in spite of the fact of the organisms having been repeatedly found in the blood and subsequently in the urine; while there are but few cases on record in which the cocci concerned in the so-called hematogenous coccus infection of the kidney have been captured during their journey through the blood.

Cabot and Crabtree studied the lesions actually found in renal infections in a series of 60 suitable cases. It is recognized that bacteria are constantly entering the lymphatics from the intestine and other sources in healthy individuals. The bacteria may be destroyed at the point of entry, or at the lymphatic glands, or they may pass through the lymphatic system into the blood stream, in which they circulate. Such organisms may be destroyed in the liver and excreted in the bile. The renal parenchyma can serve a similar function. It has been proved that the virulence of these bacteria is not necessarily reduced in their passage through the body. The excretion of bacteria does not cause pyelonephritis unless some additional factor is present. Predisposing causes of pyelonephritis are traumatism, excessive functional activity, the elimination of toxic bodies such as cantharides, urinary obstruction, calculus, new growth.

The writers state that the lesions produced by pyogenic organisms differ in essential particulars and are distinguishable from those produced by non-pyogenic organisms. The former consist of perinephritic abscess, capsular abscess, capsulitis, cortical abscess, septic infarct and diffuse suppuration. Lesions characteristically produced by the colon-typoid group of bacteria are acute pyelitis, acute pyelonephritis, chronic pyelonephritis, and pyonephrosis. Infection of the kidney with both non-pyogenic and pyogenic organisms will produce a mixture of the lesions characteristic of both groups. Cultures containing both colon bacilli and cocci are frequently interpreted as showing only colon bacilli, since this organism grows with great rapidity and readily obscures the colonies of cocci. Again, it has been assumed that the cultures obtained from one part of the kidney represented the lesions produced in the whole kidney. This the writers show to be fallacious by the actual demonstration of bacilli in one portion of the kidney, cocci in another, and cocci and bacilli associated in still other portions. The lesions of so-called ascending infection are histologically indistinguishable from the excretory type of lesion.

Caulk¹ discusses the use of *ureter catheter drainage* in the treatment of certain types of renal infection accompanied by ureteral obstruction, notably the pyelitis of pregnancy.

The normal kidney pelvis is practically empty, the urine passing on by ureteral peristalsis, and pelvis residual urine is of pathological significance. Should the residual urine in the renal pelvis become infected, the chance of cure will be dependent largely on the character and extent of the infection and also on the changes in the pelvis and

¹ Journal of the American Medical Association, 1917, lxxviii, 675.

parenchyma of the kidney. There may be recognized three grades of renal retention, dependent on the amount of distention and destruction of the elastic tissue and muscle fibers of the renal pelvis and of the accompanying damage to the parenchyma.

In the first stage the retention is slight, the contents are under great pressure, the fibers are under tension but have not lost their tone; the catheter inserted into the pelvis brings forth urine in a jet. Renal function is little, if at all, disturbed. In this type one or two catheterizations, with relief of the retention, suffices to clear up the condition. On insertion of the catheter, cloudy urine escapes, becoming more cloudy as it gets to the sediment. Following relief of retention there occurs a normal intermittent secretion or clear urine, usually in a very short period.

In the second type there is a more pronounced dilatation, and the muscle fibers are weakened and feeble, but are still capable of returning to normal function if relieved of the strain of intrapelvic pressure. The retention is much more pronounced, and kidney function is impaired. Often these patients are quite sick, with fever, chills, tenderness and a mass in the kidney region; the urine is dirty with pus and bacteria, and the cystoscope may show a thick pus plug oozing from the ureteral orifice. On ureteral catheterization, there is usually a large amount of milky, pale urine. The function of the kidney may be *nil*. In some cases the phenolsulphonephthalein appears only in traces. Such a picture would suggest that the kidney was practically destroyed, and yet on drainage, leaving the catheter in place for several days, or after intermittent catheterization, such a kidney may resume fairly normal function. The renal pelvis often completely regains its tone, as shown by pyelograms. It is in this type of case that surgical intervention might easily be avoided by ureteral drainage through a catheter.

In the third group of cases, the kidney is encroached on seriously; pelvic fibers are overstretched, incapable of returning to their normal; renal function is greatly impaired or destroyed. When functional tests following catheter drainage have proved the kidney to be functionally valueless and a constitutional menace, there is only one hope of recovery and that is removal of the kidney, provided its fellow is sound. But such patients can be materially improved by drainage of the kidney by means of a retained catheter, leaving it in several days at a time, removing it for several hours and reinserting, etc., thus reducing toxic absorption, allowing recovery from the low-grade uremia and transforming the case into a safe surgical risk to be operated on at election rather than as an emergency measure.

By ureteral drainage one can escape terminating a pregnancy as a last resort in the majority of cases. The milder cases clear up promptly and pregnancy goes on to full term.

When catheter drainage is necessary over a long period, Caulk has found that usually the patients tolerate the catheter quite well. The catheter is as a rule allowed to remain about three days, daily instillations of argyrol (25 per cent.) in small amounts being given. The catheter is then removed and allowed to remain out several hours and then reinserted. This may be kept up for several weeks.

Harris¹ cites 32 cases of *pyelitis occurring during pregnancy*. They were all examined cystoscopically and treated by the retained ureteral catheter. The right kidney was involved in every case; in 6, both kidneys were affected. In no case was the left side alone involved. In the 6 bilateral cases, the left kidney was infected after the right and to a less marked degree, suggesting a secondary infection. In every case of the series, a pure growth of *B. coli communis* was obtained from the catheterized urine from the renal pelvis, though in 7 of the cases the bladder was the seat of a mixed infection, staphylococci being present in 6 cases and streptococci in 1 instance.

Harris concludes that pyuria and pain confined to the left side are probably due to other causes than pyelitis gravidarum, and that pyuria in pregnancy associated with other organisms in the renal pelvis than *B. coli communis* probably owes its origin to some other cause than pyelitis gravidarum.

In 18 of the 32 cases, ureteral obstruction was situated from 6 to 8 inches above the ureterovesical orifice, that is, either at or just above the level of the pelvic brim. In 3 of these cases pyelo-ureterograms showed the obstruction to be 1 to 2 inches above the brim. Harris suggests that a tense *psoasparvus* tendon is a contributing cause of the ureteral obstruction in some of the cases.

In a consideration of *pyelitis of infancy*, Smith² believes there is sufficient evidence to show that pyelitis is always a blood infection, and that the bacteria frequently gain entrance to the blood by way of the lymphatics. In uncomplicated cases the lesion remains localized in the pelvis of the kidney where the organisms are excreted. Secondary infection of the kidney substance may occur by lymphatic channels from the pelvis. Such secondary infections might readily account for many "relapses." The source of infection in the majority of cases is the gastro-intestinal tract. Some cases may arise from infection in the skin, teeth, or tonsils, or in some local septic process. He accepts the common view that many cases in females arise from urethral, vulvar or vaginal foci, accounting for the greater number of cases in this sex as compared with males.

Renal Function in Pregnancy. Slemons and Morriss³ studied the non-protein nitrogen and urea in maternal and fetal blood. The specimens examined were obtained as nearly simultaneously as possible at the end of the second stage of labor, the fetal blood being collected from the placental end of the severed umbilical cord, bled into a sterile flask, and the maternal blood being aspirated from a vein in the mother's forearm. In 35 normal obstetric patients the average non-protein nitrogen in the maternal blood was 25.2 mg. (extremes 18.5 to 33.5 mg.), in the fetal blood the average was 24.9 mg. (extremes 19 to 34.2 mg.). In 16 normal patients the urea nitrogen averaged 10.5 mg. per 100 c.c. (extremes 8.4 to 14 mg.); in the fetal blood the average was 10.4 mg. (extremes 7.9 to 13.5 mg.).

¹ Medical Journal of Australia, 1916, ii, 291.

² American Journal of the Diseases of Children, 1916, xii, 235.

³ Bulletin of Johns Hopkins Hospital, 1916, xxvii, 343.

The urea nitrogen represented 44 per cent. of the rest nitrogen in the maternal and 45 per cent. in the fetal blood. The same concentration of urea in the two circulations indicates that this substance passes through the placenta by diffusion. Complications accompanied by an increase of urea in the maternal blood are also attended with a corresponding increase in the fetal blood urea, thus confirming the conclusion that urea diffuses through the placenta.

The administration of chloroform was found to alter first the fetal and later the maternal blood. Primarily, fetal blood urea was increased. Prolonged anesthesia caused a moderate increase in the non-protein nitrogen of both circulations. Asphyxia resulting from impaired fetal heart action was attended by a notable increase in the fetal blood urea.

Losee and Van Slyke¹ in a study of the toxemias of pregnancy, conclude that these toxemias can be attributed neither to failure in diaminization of the amino acids, nor to the moderate degree of acidosis observed. The nature of the toxin or toxins remains unknown. As an index of acidosis, the carbon dioxide binding capacity of the plasma was measured by Van Slyke's method. Whereas normal individuals ranged from about 55 to 75 vols. per cent. with the great majority lying between 60 and 70, and with an average of 65, 14 cases of normal pregnancy all showed figures below the average normal of 65, and 10 of them were observed on at least one day to show figures below the minimum normal of 55. Thus a slight acidosis is usually present, even in normal pregnancy. The cases of toxemia, both the eclamptic and vomiting type, showed little difference from the normal pregnancies in this respect.

The blood from the umbilical cord showed carbon dioxide binding capacity in only 1 case significantly different from that of the mother's blood; results which give no support to the presumption that the fetus elaborates amounts of acid sufficient to cause acidosis in the mother.

It was considered noteworthy that although the cases of pernicious vomiting showed the strikingly high ammonia figures that have been observed by others, the carbon dioxide binding capacity of the plasma indicated no greater degree of acidosis than may be observed in non-toxic pregnancy. Neither the blood nor the urine of eclamptic women showed, as a rule, an amino acid content above normal limits. The urinary urea in eclampsia was usually below the average normal, often strikingly so, and the ammonia often higher than the normal average. All the cases of pernicious vomiting showed strikingly high urinary ammonia percentages which, as suggested by Underhill and Rand, may quite possibly be due merely to fasting.

"The nature of the functional disturbances which cause the abnormal nitrogen metabolism observed also still awaits a satisfactory conclusive explanation. Nevertheless, the constancy of the low urea ratios in the urine in eclampsia and of high ammonia in pernicious vomiting, lends decided support to the opinion of Ewing and Wolf, that the nitrogen distribution of the urine, considered in connection with all the data in

¹ American Journal of the Medical Sciences, 1917, cliii, 94.

the case, should assist in diagnosing the toxemias of pregnancy, and in differentiating them from conditions such as nephritis and transitory gastric disorders."

Hematuria. Kretschmer¹ analyses a series of 238 cases of hematuria including only cases in which the presence of blood in the urine was apparent to the naked eye.

Hematuria, with but very few exceptions, indicates the presence of organic disease in the urinary tract. The importance of hematuria as a symptom cannot be too strongly emphasized, and it is most unfortunate that its importance is so often disregarded and belittled by both patient and physician. The bleeding is very often painless, and not infrequently symptomless, so that an accurate diagnosis from this symptom alone is not possible. Instead of making an accurate diagnosis, vague and indefinite terms are used in describing the hematuria, styptic drugs are administered, after which both patient and physician wait for the bleeding to stop.

Since tumor and tuberculosis are so commonly the cause of hematuria, it is apparent that early diagnosis is essential if favorable end-results of treatment are to be hoped for. Yet many patients give a history of several years' duration—twenty years in one of Kretschmer's cases—before they were subjected to a thorough and complete examination. To arrive at a proper diagnosis, in some cases it is necessary to use all the methods of diagnosis.

Of the writer's series, a positive diagnosis was made in 197 cases. Of these, tumors of the bladder were responsible for bleeding 60 times, or in about 30 per cent. There were 25 prostatic lesions, 12 being carcinomatous. Tuberculosis was second in point of frequency, there being 33 cases of renal and vesical involvement. New formations of the kidney were third in point of frequency; of the 74 renal lesions, tumor was present 12 times. Thus in nearly 50 per cent. of the 197 cases, new formation was the cause of hematuria.

In another group of 14 cases, the source of the bleeding was determined, but the cause not definitely established. In 1, a high blood-pressure may have been the cause. Three cases were operated upon in other clinics and the operative findings not learned. Several of these cases were seen before pyelography and cultures of the urine were carried out as a routine procedure.

Finally, in 25 cases the origin of the bleeding was not determined. Of the group, 5 refused instrumental examination. The remaining 20 patients presented themselves at a time during which the urine was free from blood. In 6 cases in which complete examinations were made, all findings were negative. Kretschmer does not think that one is justified in assuming that these 6 cases belong to the group of "essential hematuria," but that they are the expressions of our present diagnostic limitations, and that they should be subjected to further clinical study.

In Walther's² series of 74 cases of hematuria, the bleeding was a

¹ Journal of the American Medical Association, 1917, lxxviii, 598.

² Medical Record, 1917, xci, 854.

symptom of new growth somewhere in the genito-urinary tract in 51 per cent. of the cases. Furthermore, 72 per cent. of these tumors were malignant. Urinary calculi occurred in 13 cases, or 19 per cent., while tuberculosis of the kidney accounted for 5 cases, or 7 per cent. In 4 cases all findings were negative, and "essential hematuria" was the only available diagnosis.

Payne and MacNider,¹ in a study of 3 human and 6 experimental cases, have demonstrated definite lesions in the renal medulla as the exciting factor of so-called "essential" hematuria. The following sequence of events had apparently taken place in the pathology of the kidney. An infection had occurred which had been localized to foci in the medulla followed by repair of these infected areas by formation of dense masses of connective tissue. This fibrosis produced an obstruction to the venous return from the medulla and papillae through the venulae rectae. As a result of this obstruction, varicosities developed, which not only appeared in the substance of the papillae and just under the epithelium covering the papillae, but finally ruptured on the free surface of the papillae and discharged their blood.

Concerning treatment of these cases, the authors believe that "in acute and subacute cases in which an infectious agent can be isolated, it is well to try autogenous vaccines. Given a case of mild unilateral renal hemorrhage without pus, a negative röntgenogram, a normal pyelogram and little or no functional impairment, which can be kept under constant observation, we believe that it should be treated conservatively by epinephrin to the kidney pelvis and serums hypodermically. With this method, there is always danger of masking the one symptom, hemorrhage, while a possible malignant or tuberculous process is left unrecognized to progress. In dealing with such a case of unknown pathology, these procedures are to be condemned unless the patient can be kept under control and constant observation. When the conservative treatment fails, or if the bleeding has already existed for several months with a resulting anemia coupled to an uncertain diagnosis, then we believe that surgery should be resorted to without delay." The one surgical procedure which has yielded the best results is in their opinion nephrotomy with bisection from pole to pole and down to the pelvis. It probably cures through thrombosis or the establishment of a collateral circulation within the kidney, which relieves the distention of the varicosities. "In cases in which the bleeding has produced a critical condition of the patient, and in those cases in which nephrotomy has failed to relieve, nephrectomy is clearly indicated, provided the other kidney is present and its functional capacity good."

Renal Anomaly. Abell² reports a most unusual anomalous development of the genito-urinary tract, consisting of a pelvic kidney situated in front and to the left of the sacro-iliac synchondrosis. Examination of both lumbar regions revealed no evidence of a second kidney. No

¹ Journal of the American Medical Association, 1917, lxvii, 918; see also Surgery, Gynecology and Obstetrics, 1916, xxiii, 76.

² Surgery, Gynecology and Obstetrics, 1916, xxiii, 33. .

uterus, tubes, ovaries, vagina, nor remnants of the same, could be detected.

Diagnosis of Renal Tuberculosis. Morton¹ describes a method based upon the observation of Murphy and Ellis² that white mice which have been exposed to *x*-rays are made markedly more susceptible to bovine tuberculosis than normal animals, due, they believe, to the destruction by the *x*-ray of the lymphoid tissue, their studies having indicated that the lymphoid tissue is one of the most important factors in the defensive mechanism against tuberculosis. Morton's experiments demonstrate that the same conditions hold for the human strain of the tubercle bacillus in the guinea-pig. His method is as follows: "The guinea-pig was placed in a pasteboard box of such size that it could not move around and then radiated for a period of ten minutes with the Coolidge tube, the target being twelve inches distant from the base of the box. A 5-milliampère current was passed through the tube, backing up $8\frac{1}{2}$ inches of spark between points. The Snook interrupter was the type of machine employed. No aluminum or leather filters were used. From 1 to 2 c.c. of urine were injected intraperitoneally according to the amount at hand. After ten days, the guinea-pigs were killed and examined for the lesions of tuberculosis. As in the normal animals, the usual sites of election were the spleen, mesenteric lymph glands, and liver. The lesions varied with the severity of the infection—sometimes the spleen was riddled with a mass of caseous nodules 2 to 4 mm. in diameter, while at other times the spots were more nearly the size of a pin-head but distinctly pathognomonic. The lymph glands were usually from 1 to 1.5 cm. in diameter and caseous, and, as a rule, the liver had scattered over its surface nodes similar in size to those of the spleen. Films taken from these situations and stained for tubercle bacilli were used to confirm the gross diagnosis. Microscopically, the picture was one of coagulation necrosis and caseation with a zone of endothelial cells, but no formation of giant cells, and a striking absence of the small round-cell infiltration. There was also no evidence of an enclosing fibrous layer, such as is commonly seen in the slow-growing tubercle."

"In renal tuberculosis when it is necessary to resort to the use of animals, it ordinarily requires from five to seven weeks, while by the use of *x*-rayed guinea-pigs, the diagnosis can be made in from eight to ten days."

¹ Journal of Experimental Medicine, 1916, xxiv, 419.

² Ibid., 1914, xx, 397.

GENITO-URINARY DISEASES.

BY CHARLES W. BONNEY, M.D.

SURGICAL CONDITIONS OF THE KIDNEY.

Nephrolithiasis. The most important paper on this subject which has come to my attention during the year is that of William J. Mayo,¹ who presents an analysis of all the patients who were operated upon in his clinic from January 1, 1898, to December 31, 1915. There were 450 in number, upon whom 484 operations were done, some being subjected to as many as three operations. It is most interesting to note that in this large number of cases there were only 3 deaths, which gives a percentage of 0.6. Equally interesting is the statement of the author that this low mortality rate was attributable rather to the care with which the cases were selected than to any superior technic in the performance of the operations. The making of an accurate diagnosis, the estimation of the kidney function and the preliminary treatment of the patients comprised the measures used in bringing about the excellent operative results. In late years the *x*-ray examination has invariably been supplemented by pyelography, which assures more definite localization of stones than the former method can possibly give. As illustrative of this point, 2 cases are mentioned in which, before the use of pyelography, the author exposed the right kidney on the basis of the *x*-ray pictures only to find that the stones which were shown were in the gall-bladder directly in front of the kidney. Braasch,² in discussing the localization of stone, points out that the essential thing to determine is whether it is in the renal pelvis, in a calyx, or in the renal parenchyma. It has been found that if it be situated in the pelvis, the shadow may be obscured by the pelvic outline, so that the true position of the stone can be learned only by comparing the pyelogram with the original *x*-ray picture. When the stone is in a calyx, its outline may be seen through that of the calyx, which is usually characterized by deformity. The comparative size of the calyx can also be ascertained and thus additional information relative to the possibility of removing the calculus through the renal pelvis can be obtained. Stones in the cortex can be seen clear of the pelvic outline.

Bilateral calculi, calculi in anomalous kidneys, recurrence, and surgical treatment, as well as operative and postoperative complications and sequels are thoroughly discussed in Mayo's paper. There

¹ Surgery, Gynecology and Obstetrics, January, 1917.

² *Ibid.*

were 48 patients who had stones in both kidneys. In these cases the rule has been to remove the stone from the least involved kidney, provided that there was no acute pathological process in the other kidney which required immediate attention. Usually in from ten to fourteen days after the first operation the second kidney was operated upon.

This seems to be a shorter period than that after which many surgeons have been able to attack the disease in the second kidney. In cases in which the second kidney was known to retain a considerable degree of functional capacity, operation has sometimes not been done unless symptoms made it urgent. These were cases in which large stones had already destroyed a portion of the organ and in which it was feared that their removal might cause sufficient additional damage to render nephrectomy necessary. In one-half of the cases of bilateral stone, the second kidney was pyonephrotic, the condition being such as to necessitate its removal.

There were 3 cases of single kidney containing stone and 2 in which stones were present in a horseshoe kidney. Stones were also found in two patients who had a duplication of the renal pelvis, the caudal pelvis being involved in both cases.

It has been the experience in the Clinic that multiple stones in the cortex of the kidney are very likely to recur, but, fortunately, multiple stones of this kind are rare; Braasch found them in only 5 out of 48 cases which he studied. One of the most frequent causes of recurrence of stone has been the conservation of a badly damaged kidney, which was of little use so far as function was concerned and which, moreover, proved to be a menace to the patient's health. Consequently, in cases of this kind, nephrectomy is advised, provided that the function of the other kidney is sufficient to maintain the needs of the bodily economy.

This practice is fully in accord with that of experienced renal surgeons everywhere. The question of proper measures to be followed in cases in which both kidneys are extensively damaged is taken up. When the stones have been removed, the renal pelvis is drained by a rubber tube passing out through the cortex, and each calyx containing a stone which has extended out into the parenchyma by atrophy necrosis until it can be felt with the finger as a softened area in the cortex, is also drained in like manner. Rubber tubes and rubber tissue drains are recommended for this purpose.

Attempts to remove the stone through too small an incision is considered another cause of recurrence, inasmuch as fragments may be left and act as nuclei for the development of other stones. It is not only necessary to remove as many stones at operation as are shown in the *x-ray* picture, but also to explore the kidney thoroughly to determine if there may not be even a greater number than the *röntgenogram* has reproduced. It is well known that several stones, if placed one upon the other, may give only a single shadow.

It is the practice in the Clinic to have every patient *x-rayed* before he is discharged, in order to see if any calculi have been left in the

kidney. The cases of recurrence of stone are considered to be less than 10 per cent.

Pelviolithotomy, which is rightly regarded as the operation most generally useful for renal calculus, was performed in 206 cases. The kidney is fully liberated so as to give a good exposure of its pelvis, and then, if the stone can be palpated, it is removed by direct incision, after which the pelvis is explored for others. If the stone cannot be felt, the pelvis of the kidney is also widely opened, the stone located by the finger and removed. No attempt is made to locate it by needling the kidney, the pelvis being opened at once and the stone sought for in the manner just described. Catgut sutures are used to close the incision, and the fatty capsule is sewn into place, after which the renal space is drained with multiple rubber tissue drains. In simple cases the renal pelvis itself is not drained.

In 34 combined pelviolithotomies and nephrolithotomies, multiple drainage was employed. Nephrolithotomy alone was done in 40 cases, all of them being complicated. The author judiciously calls attention to the danger of hemorrhage which is invariably associated with such an operation and to the consideration of which ample space was given in this review in the year 1913. In common with other surgeons, Mayo has had cases in which the bleeding was so severe as to make removal of the kidney necessary. In view of the danger of the operation, nephrolithotomy was not performed in any case unless there was some reason which made it imperative, as, for instance, when the kidney was firmly bound down as the result of a previous operation. When infection was present, the drain was passed through the cut cortex into the pelvis.

In other cases, drainage was dispensed with. When multiple stones were present, the practice was to drain separately each cavity formed by the removal of the stones, using small cigarette drains.

Nephrectomy was done in 204 cases and it is most gratifying to learn that both the examination of the specimens removed and the subsequent history of the patient gave rise to no regrets as to the choice of operation. In fact, it is stated that it would have been better to perform nephrectomy in some cases in which an attempt was made to preserve the kidney.

Associated pyonephrosis was the most frequent condition which rendered nephrectomy necessary. The subcapsular enucleation of the organ is recommended in cases which present more than ordinary technical difficulties.

As to complications, hemorrhage and laceration of the kidney are those to which most attention is devoted. The author states that he has succeeded in controlling hemorrhage resulting from injury to the renal vein by fine catgut sutures, and that the patients so treated have gone through their period of convalescence the same as those to whom the accident did not happen. The same method is recommended for controlling tears in the vena cava. If large arteries are injured, however, the author believes that the patient's interest will be best safeguarded by removing the kidney. He cites one case in which an artery of con-

siderable size had been injured and in which later a secondary hemorrhage rendered nephrectomy necessary. The kidney removed showed that the injury and ligation of the artery had resulted in acute degeneration of almost the entire organ. A similar case which I saw was mentioned in this review in 1913. With regard to lacerations of the pelvis of the kidney, it has been the author's experience that primary union has always followed careful suture supplemented by the application of a fatty fascial flap.

An extensive study of the association of renal stone and malignancy has been made by Martin and Mertz¹ who report one case and present an analysis of 108 cases which they collected from various sources. Of these, 36 were reported by French authors, 30 by English, 21 by American, 14 by German, 2 by Russian and 1 by Italian. This associated condition was found to be five times as common in males as in females. The average duration of the symptoms produced by calculi was nineteen years, those due to malignancy approximately five months. The average age of the patients was fifty years, the youngest being sixteen and the oldest seventy-seven. It was found that the left kidney was affected more frequently than the right, but this incidence is probably fortuitous, for there is no evidence adducible to show that one kidney would be more likely to be affected than the other. Epithelial neoplasms were found to be the variety commonly associated with calculus and were most frequently located in the renal pelvis. The next most frequent variety was cystic tumor, mesotheliomatous and sarcomatous being the rarest of all.

From a study of this large number of cases, the authors conclude that there is a definite and constant relation between stone and epithelial tumors of the same kidney, the stone in the majority of cases being the primary lesion, predisposing to the proliferation of epithelium by the irritation which it produces. In mesotheliomatous tumors they consider that stone formation is secondary. In two cases of sarcomatous growth associated with stone, the relationship could not be determined, while in a third case the stone was shown to be secondary. They furthermore believe that calculus may be one of the etiological factors in the production of a single large cyst; also that there is no causative relation between polycystic kidney and calculus, the latter, when present, being secondary or merely an accidental association.

In discussing the treatment, the opinion is expressed that if the malignant process is found at operation to have extended beyond the renal capsule, it is useless to remove the kidney. Personally, I see no reason why the operation should not be continued, provided there are no insurmountable technical difficulties, for if it be possible to remove the structures invaded, some good may result, whereas if no attempt whatever is made, the case is certainly hopeless. Naturally, the extent to which the contiguous parts are invaded will determine the operability of any given case. In one case studied by the authors, recurrence took place in the wound, the malignancy not having been suspected at the time the kidney was removed.

¹ Mississippi Valley Medical Journal, March, 1917.

Polycystic Kidney. In *PROGRESSIVE MEDICINE* for 1915 two papers on polycystic kidney were reviewed; one by Barnett, who dealt principally with its frequency, and one by Lund, who discussed its symptomatology and reported 4 cases in which he had operated. During the past year another important contribution to the subject has come from the Mayo Clinic. Braasch¹ has investigated the cases recorded there up to May, 1916, and finds 41. The average age of the patients was forty-six years, but 10 patients were under forty years. As to the subjective symptoms, it was found that pain was not usually severe, though interference with drainage resulting from obstruction by blood clots or stones may give rise to severe colic and make the diagnosis of the real condition difficult. Hematuria occurred in 16 of the cases. It was usually profuse and continuous, and was probably caused by rupture of the cysts.

Intracystic hemorrhage, of course, may be present without causing hematuria. The renal insufficiency in this affection resembles that of chronic interstitial nephritis; hence, young adults with impaired kidney function should be considered as possible subjects of this congenital disease. Records of blood-pressure were available in only 16 cases, in 7 of which it was normal. Braasch states that an extremely high systolic or diastolic pressure associated with a specific gravity of the urine as low as 1003 or 1004 and only a trace of a returned phthalein contra-indicates even a Rovsing operation. Polyuria, with low specific gravity of the urine, indicates that renal insufficiency is either impending or is actually present. Of course, the functional tests here are of value, but Braasch calls attention to the fact that even a normal return of phenolphthalein or similar substances does not exclude the possibility of polycystic kidney. When only a trace is found, he believes that a Rovsing operation is inadvisable and that nephrectomy is warranted only very rarely. Ophthalmoscopic examination was negative. Renal tumor was noted before operation in 31 of the 41 cases. In more than 50 per cent. of the cases pyelography revealed a deformity of the pelvic outline, flattening or obliteration of one or more of the large calyces being frequently demonstrated. Others showed retraction and broadening, and some elongation or rounding of the true renal pelvis; displacement of the pelvis from its usual position was also noted. As retention of the injected medium is frequent in polycystic kidney, bilateral pyelography is not advised. Nephrectomy was done in 14 cases, and in 10 of them the patients were alive one to ten years after the operation. There was one postoperative death. Another death occurred from malignant disease in the pelvis three years after a nephrectomy.

The Rovsing operation was performed ten times. Seven of the patients were living from a few months to five years after the operation. Five patients were operated upon before the value of the Rovsing operation had become known. These operations were exploratory. One patient died two weeks after the operation and two others died within

¹ Collected Papers of the Mayo Clinic, 1916, viii.

two years after the operation. In 8 cases the polycystic kidney was discovered during the course of operations for other conditions, and 4 cases were found at autopsy. In the remainder of the series no operation was done, as the diagnosis of bilateral polycystic disease was made.

Hydatid Cyst. An exhaustive paper on this subject has been contributed by Alexander Noguiera,¹ in which he discusses its pathology, symptoms, and treatment. The kidneys, as is well known, are affected less frequently by the echinococcus than other organs of the body. It may occur either as a primary or a secondary infection, and may affect persons of all ages, although it is more common in those who have reached middle life.

Primary renal echinococcus disease may reach the kidney either through the general circulation after the parasites have passed through the pulmonary circulation, or the parasites may pass through the subperitoneal venous plexuses around the intestine, some of which anastomose with the renal veins and the perirenal plexuses.

In secondary echinococcosis the transplantation may take place (1) *in situ*; (2) on a serous membrane, especially after rupture of a hydatid cyst; and (3) through the general circulation.

In clinical renal echinococcosis the kidney, as a rule, is the only organ affected. In the author's collection of 43 cases, cysts were found in other organs in 5 cases only. Among the 43 cases there were 3 cases of multiple cysts in one kidney, with coexistence of cysts in other organs; there was only one case of bilateral kidney involvement, and in this case the cysts were multiple.

Usually the cyst develops in the renal cortex and destroys by compression the tissue that surrounds it. It distends the capsula propria, displaces the perirenal fat and, when fully developed, occupies almost the entire kidney. It is separated from the previously normal parenchyma by a pale-colored zone which contrasts sharply with the rest of the kidney. The cyst frequently occupies one of the poles of the viscus, being either sessile or pedunculated, or it may occupy the greater part of the interior of the organ.

It may include or displace the calyces and the ureter, or it may open into the pelvis.

A kidney, the seat of an echinococcus cyst, may be diseased in other ways. It may be the seat of an interstitial nephritis, of lithiasis, or of tuberculosis. Very often a slight grade of nephritis may be attributed to the presence of the cyst. The cause of this nephritis is not always evident.

The urine in the early stage of the disease may be normal, but may subsequently contain traces of albumin. After rupture of the cyst into the renal pelvis, the characteristic vesicles will be found in the urine as well as parts of more or less modified membrane. They are at times very thin and may resemble mucus or mucopus, but they can readily be distinguished from these by the appropriate reactions. The absence from

¹ Urologic and Cutaneous Review, May, 1917.

the urine of roots of the echinococcus is of no diagnostic value. The urine may, according to conditions, be purulent or hemorrhagic. Occasionally it contains eosinophilic cells.

In some cases renogastric, renobronchial and reno-intestinal fistulae occur; but these are rare. The cyst may rupture also into the lumbar region or into the peritoneal cavity. The suprarenal gland is often damaged in the course of the pathological process.

Usually the cysts contain daughter vesicles or remnants of daughter vesicles, but these may be absent.

The cyst contents may remain sterile or may become infected. In the latter case, the colon bacillus and the staphylococcus are usually the offending organisms. All cysts that rupture into the pelvis become infected sooner or later.

Secondary changes are induced, changes such as round-cell infiltration, with an excess of the eosinophilic cells and a diffuse adenomatous degeneration of the renal tissue.

These cysts may remain latent for years and are usually first recognized when they give rise to pain or tumor. Pain is usually present and was the symptom complained of by the patients in 6 of 8 cases. The pain may be a sensation of weight or may be of a neuralgic character. It may radiate from the lumbar region to the lower part of the pelvis or to the lower extremity of the affected side. The cyst may press on the stomach or the colon or on the inferior vena cava, in which case there may be ascites and edema of the lower extremities.

The pain may be that of renal colic due to the discharge of vesicles or to the rupture of the cyst into the renal pelvis.

The tumor due to the presence of the cyst may be situated in the groin or in the abdomen, or more rarely in the lumbar region. A cyst of the superior pole usually extends toward the thorax, and a cyst of the inferior pole toward the umbilicus. Cysts may move with respiration, and careful palpation may determine whether they are sessile or pedunculated. The cyst rarely fluctuates and may be of mixed consistency, solid portions alternating with liquid portions. Percussion shows that a retroperitoneal tumor is present. All cases should be examined after insufflation of the colon. The urine may be normal or diminished in quantity. Macroscopic hematuria is rare. One case in the literature has been cited in which echinococcus roots were found in the urine.

Cystoscopy is of advantage in studying the appearance of the ureteral orifices in these cases. Radiography may prove profitable in determining the size and the relations of the cyst.

The diagnosis of hydatid cyst of the kidney is established by the presence of vesicles or pieces of vesicle in the urine or by the presence of membrane in the urine. Occasionally a pelvic hydatid cyst that has passed its contents into the urinary tract through the bladder wall will give rise to these urinary findings. These cysts may be suspected when there is neither nephritic colic nor lumbar tumor, and cystoscopic examination will reveal the communication between the bladder and the cyst. We should also consider the possibility of an extrarenal cyst rupturing

into the pelvis of the kidney. Such a possibility is more theoretical than practical.

When vesicles are absent from the urine, diagnosis as to the localization of a cyst is difficult. Ureteral catheterization will, however, show that one of the kidneys is insufficient. Pedunculated cysts on the inferior surface of the liver might easily be confused with renal cysts. Other hepatic cysts show evidence of being intraperitoneal, not retroperitoneal. Marked eosinophilia is not invariably present. The Weinberg reaction is absent in about 50 per cent. of cases.

Hydatid cyst of the kidney should not be considered a benign disease, even though spontaneous cure is theoretically possible by the evacuation of the contents into the renal pelvis and subsequent cicatrization of the pericyst.

Prolonged drainage of a cyst through the renal pelvis neither completely evacuates the cyst nor does it prevent gradual destruction of the kidney. Involvement of the peritoneum, with the formation of multiple cysts, is always a serious condition. Another grave complication is infection of the kidney.

With regard to treatment, indications for nephrectomy depend upon the functional sufficiency of the non-affected kidney, the functional value of the affected kidney and the degree of adhesions around the affected kidney.

The indications for nephrectomy are:

1. Where the total parenchyma of the kidney is compromised by the presence of multiple cysts.

2. When, through atrophy, the renal parenchyma has become incapable of carrying on urinary elimination or when there is obstruction of the calyces corresponding to intact parenchyma.

3. When other lesions, abscess, pyonephrosis, tuberculosis, etc., coexist.

4. When there is a urinary fistula as a result of a previous operation.

Contra-indications to nephrectomy are:

1. Insufficient functional capacity of the opposite kidney.

2. The persistence of an appreciable amount of healthy parenchyma in the affected kidney, which satisfactorily carries on urinary function even though a cyst is present.

3. Adhesions around the cyst that are so thick that their liberation would jeopardize the life of the patient. Sometimes the cyst alone can be removed (partial nephrectomy). Fourteen operations of this nature have already been done for hydatid kidney. Usually the operation is done when the cyst can be readily separated from the kidney and the amount of kidney tissue to be left behind is worth conserving.

Marsupialization of the cyst is sometimes done. It will succeed if the cyst is not too large, if it is not infected and if it does not communicate with the urinary excretory passages. In the latter case after marsupialization, a fistula will result or a cavity that will become infected.

In the course of the marsupialization operation the sac is evacuated, formalized and the vesicles and membranes extracted. Before fixation of the sac, a careful search should be made for neighboring cysts.

X-rays in the Treatment of Sarcoma of the Kidney. Alfred Friedländer¹ reports a case which is interesting because of the marked degeneration of the tumor mass as seen in a postmortem examination, which showed widespread areas of necrosis, apparently of a gradually progressive character in contradistinction to such as are due to thrombosis or infection. The x-rays were tried in this case because the tumor was regarded by surgeons as inoperable. The patient was a child four years old. In the twenty treatments that were given, the Coolidge tube was used. At first there was a diminution in the size of the tumor. The child gained in weight and strength. Later, however, the tumor again began to increase in size. Death was due to bronchopneumonia complicating measles. In spite of the fact that the child did not get well, the apparent results of treatment, as shown at autopsy, are encouraging, and, in Friedländer's opinion, favor the use of the x-rays in similar cases.

Aneurysm of the Renal Artery. Two cases of this rare condition have been reported by Trulli.² The first occurred in a man, aged seventy-four years, whose general condition seemed good and who had been up and about until a few days before his death. He had had some pain in the back and a feeling of heaviness in the lower extremities. Despite his generally good condition, the profuse hematuria, with which he was affected at the time he came under the author's observation, made it seem probable that he had a malignant growth. At autopsy, an aneurysm the size of a hen's egg was found in a branch of the right renal artery. There was also general arteriosclerosis.

The second case was that of a man, aged sixty-six years, who had suffered from attacks of angina pectoris for sixty years, and who, during the year prior to the time that he came under observation, had also complained of pains in the region of the left kidney and had had two attacks resembling renal colic. Finally, he was seized with a violent pain over the left kidney, which was followed by hematuria of three days' duration. These phenomena came on after severe muscular effort. Upon examination, a swelling was found in the region of the left kidney. It did not pulsate, and no murmur could be heard over it upon auscultation. An operation was advised, but refused, and a short time later the patient died of pneumonia. At autopsy, a true aneurysm of one of the inferior branches of the renal artery was found. There was a large calculus in the kidney.

Narrowing of the Lower End of the Ureter due to Gonococcus Infection. Leo Buerger³ presented an interesting case of this kind to the New York Academy of Medicine. The patient complained that his urine had been cloudy for more than a year. Gonococci, however, had not been demonstrated and the case had been considered one of cystitis, possibly tuberculous. Upon cystoscopic examination the left half of the trigonum, the area lateral to it and also the sphincteric area were found to be covered with red follicles, some of which had undergone

¹ American Journal of Diseases of Children, December, 1916.

² Il Policlinico, October 15, 1916, xxiii, No. 42.

³ New York Medical Journal, October 21, 1916.

cystic degeneration. The urine obtained from the right kidney was normal in every respect, except for a slight trace of albumin. Catheterization of the left ureter was somewhat difficult owing to the narrowing of the lower end of the canal. No urine was obtained until the catheter had passed 20 cm. above the ureteral orifice. When this point had been passed, however, a free outflow of cloudy and slightly blood-stained urine took place. The first specimens were discarded. The last were submitted to bacteriological examination and showed pus, together with a pure culture of gonococcus. The latter organism was also found in the bladder urine. The left ureter and pelvis of the kidney were thoroughly washed with argyrol and the patient was given autogenous vaccines. Improvement was noticeable almost immediately, and within three weeks the urine had become clear and no gonococci could be recovered from it.

Buerger also reports upon other forms of stricture of the ureter which have come under his observation. He classifies them as congenital and acquired. Of the former, there are some in which more than the normal degree of narrowing occurs at the site at which the urethra passes into the pelvis and others in which there is a marked stenosis or atresia at the lower end of the tube. Defects at the lower end may be subdivided into a double aplasia with complete absence of a portion of the ureter and without any sign of an orifice in the bladder; atresia or aplasia with distinct indications of the presence of an orifice; congenital narrowing; and narrowing with prolapse and cystic dilatation of the intravesical part of the ureter. The acquired cases are due to traumatism and inflammation, the greater number of the former being caused by surgical operations for impacted stone, and some by injuries received during gynecological operations. Inflammatory cases may be due to involvement of the ureter itself or to peri-ureteral lesions. Another cause is thought to be inflammation of the fatty tissue either about the ureter alone or around the pelvis of the kidney. Lesions caused by calculi are also discussed. With reference to stenosis at the ureteropelvic junction, further changes take place gradually until, in course of time, a large hydronephrosis is formed.

Preliminary Renal Drainage. Attention is called by John R. Caulk,¹ of St. Louis, to the benefit to be derived from a preliminary course of renal drainage either by ureteral catheterization or by open operation. With reference to the former, it may be stated that in cases of unilateral infected hydronephrosis in which the patient has suffered from loss of rest and has developed toxic symptoms on account of discomfort due to the enlarged kidney and absorption, respectively, and in which the other kidney, though comparatively good, has suffered as the result of excreting the toxic products, ureteral drainage of the hydronephrosis will greatly ameliorate his condition. Caulk has found that such preparatory treatment makes convalescence after operation very much easier than it is in cases in which the hydronephrotic kidney is removed at once. Unilateral pyonephrosis likewise is a condition in which great benefit is derived from drainage through the ureteral catheter, which quickly

¹ *Annals of Surgery*, May, 1917.

relieves the patient of toxic symptoms caused by the absorption of pus, so that after a few days he is so much improved that radical operation can be done with comparative safety. The author states that the wonderful effect drainage exercises in these very toxic cases is well-nigh incredible. Some of his patients in whom the functional capacity was almost unreadable improved so much after a short time that the color index nearly reached the normal.

Bilateral renal drainage is regarded as applicable only to non-tuberculous retentions and is considered chiefly with relation to its use in calculus pyonephroses, especially in cases in which the function of both kidneys is very low and in which the patients are bordering upon uremia. A case is cited of one patient who was apparently about to succumb, but who improved sufficiently under drainage and lavage as to be ultimately cured by a two-stage operation on either kidney. It will be readily understood that the two-stage operation is not advised as a matter of routine, but in certain cases, particularly in children who are very toxic as the result of an absorption from pyonephroses, he has found that a preliminary nephrotomy, followed later by removal of the diseased kidney, has enabled him to save many patients whose condition was such that they could not have withstood the shock of a primary nephrectomy. He states that a number of such children have been operated upon when in the most critical condition without any mortality. The kidney is exposed through the usual lumbar incision and freely drained. Gas anesthesia is employed and the kidney is removed in two to four weeks. The author states that the adhesions formed at this time are delicate, the kidney small, and that removal has been easy. In only one instance has he been obliged to do an intracapsular operation. In bilateral calculus, pyonephrosis and pyelonephritis in adults in which both kidneys are almost completely filled with large coral stones, the author has likewise done the two-stage operation with good results in a number of cases, and he expresses the opinion that the preliminary drainage of the kidney secured by nephrotomy not only relieves absorption, thereby improving the patient's general condition, but also lessens engorgement of the kidney, allows the wound to become walled-off by granulations and renders the removal of the large calculus much less dangerous than it would be at the first operation.

DISEASES OF THE BLADDER.

Tumors. A very interesting contribution to this subject, based for the most part upon the study of 113 neoplasms at the Mt. Sinai Hospital during the last ten years has been made by Leo Buerger,¹ whose work in this line is familiar to the readers of *PROGRESSIVE MEDICINE*. As a result of these studies, Buerger has concluded that an accurate pathological diagnosis between malignant and benign growths can be made. If further experience will prove this contention, the painstaking investigations of the author will certainly be of great value to patient and

¹ New York Medical Journal, October 28, 1916, civ, No. 48.

surgeon alike, for in the past it has happened all too often that neither the cystoscopist nor the pathologist could state definitely whether an infiltrating papillary neoplasm was benign or malignant. The characteristics upon which Buerger bases a **DIAGNOSIS OF MALIGNANCY** are irregularities in the shape and size of the cells, together with an abundance of chromatin in their nuclei, multinucleated cells, others with atypical mitosis, and finally giant cells. Other characteristics also observed at times were disturbance in the relation of the cells to each other whereby their typical palisade arrangement was destroyed, the presence of long fusiform cells, infiltration of the stroma, penetration of the basal membrane, the presence of cells in the capillaries and also infiltration of the submucous or muscular coat by epithelial cells. In infiltrating papillomata the author states that the diagnosis of malignancy can be definitely made upon the finding of considerable areas of muscle between the islands of epithelium. With regard to malignant change taking place in benign papillomata, Buerger states that the evidence which he has accumulated favors such a transformation. He was able to demonstrate it to his own satisfaction in 13 out of 52 cases of carcinoma. It is interesting to note that the author has found this malignant transformation to take place in the superficial portions as well as in the deeper parts of the tumor. In fact, he believes that in the earlier stages the villi are the only parts involved, but that as the malignant process advances it gradually affects all parts, and even infiltrates the entire thickness of the vesical wall. Whatever may have been the contentions of different pathologists with regard to this matter, there has been abundant clinical evidence that growths benign, at least in the clinical sense, eventually assume characteristics of malignancy and destroy the patient. The same thing obtains in papilloma of other mucous surfaces. I have seen some affecting the mucous membrane of the mouth undergo malignant changes, and the frequency with which papillary growths in the mammary gland assume malignant characteristics is no longer a matter for discussion or doubt. The same thing I always believed to be true of vesical papillomata.

Buerger differentiates six different types of papillary tumors undergoing carcinomatous transformation, but as his classification is based upon only fifteen specimens, it is probably better not to accept it until a greater number of specimens have been studied. It is in the superficial parts, the tufts of the papillary masses, that the changes previously enumerated are to be looked for. Naturally, in making a diagnosis from specimens removed through the operating cystoscope, one would need the services of a pathologist who is not only thoroughly competent to detect minute tissue changes, but who has actually had considerable experience in the study of such specimens.

As to the **TREATMENT OF BLADDER TUMORS**, the consensus of opinion at the present time seems to be that small pediculated papillomata should always be treated by *fulguration* through the cystoscope, and that certain larger growths that are readily accessible can likewise best be treated by this method, even though a number of applications be required. With regard to those larger papillomata which show a ten-

dency to coalesce, there are many surgeons, myself among the number, who believe that excision is sometimes a preferable procedure, and particularly is this true in those cases in which it is not possible to obtain a pathological diagnosis as to the benign or malignant nature of the growth. Geraghty,¹ of the Johns Hopkins clinic, however, expresses the opinion that even in such cases fulguration should be tried. Of course, in any excision or resection of infiltrating papillomata the danger of implanting particles of tumor in the remaining tissue must be borne in mind. In fact, the danger of such an occurrence has proved the great drawback to a cutting operation. In this connection a suggestion made by Edwin Beer,² of New York, a pioneer in the fulguration treatment, is of great interest. In order to guard against the implantation of tumor cells, he removes the growths entirely with the Paquelin cautery, using a hooked point and burning every portion of the neoplasms to a crisp. Every suspicious spot is likewise cauterized, and also the edges of the vesical incision. Beer states that the cautery may be used in this manner for an hour without causing any more postoperative discomfort than is usually experienced after a simple suprapubic cystotomy. As to the technic of the cystotomy, it is considered important to draw the bladder well out of the abdomen before opening it, in this way guarding the perivesical space from implantation while the tissues over the site of incision are thoroughly, though gently, exposed by gauze dissection. The author states that in the usual cutting operation every step, such as repeated sponging, the grasping of the tumor with forceps, cutting around its pedicle, etc., predisposes to recurrence, as such measures break off viable masses of cells which become implanted and give rise to new growths.

Geraghty also states that *radium* has given him good results in *malignant growths*, particularly when placed directly against the tumor by means of Young's radioscope, the other parts of the bladder being screened while the application is made.

Young³ has devised an instrument which carries the radium in its beak and states that it has proved very satisfactory in making applications to the neck of the bladder, the trigonum and certain portions of the lateral and posterior walls. The radium, contained in a slender glass tube, is put into a platinum capsule, which is placed in the open tubular end of the beaked instrument. The latter is then passed through the urethra, the obturator withdrawn, the bladder irrigated and the lens-carrying system of the cystoscope passed through the tube. The diseased region is found and the capsule containing the radium is deposited upon it. A mechanical contrivance attached to the table is used for holding the instrument in place. For the treatment of tumors in other parts of the bladder, the author has devised another instrument, made up of two hollow halves, which can be separated by an external contrivance and made to carry the radium out to a position parallel to the shaft and about 2.5 cm. distant from it. This instrument carries the

¹ New York Medical Journal, October 28, 1916, civ, No. 18.

² Surgery, Gynecology and Obstetrics, June, 1917.

³ Journal of the American Medical Association, April 21, 1917, lxxviii, No. 16.

capsule of radium in its beak. For tumors well back on the posterior wall, a third instrument has been found more convenient. In this the beak carrying the radium revolves about its center, being operated by two wires in the shaft and a screw outside. The frequency of application and the duration of each treatment varies according to the conditions in the individual case, although the author recommends an intensive treatment. If possible, the applications are made every second or third day, a different portion of the tumor being exposed to the action of the radium on each occasion. In some cases a few applications of the high-frequency current seem to be beneficial by causing the destruction of considerable portions of the tumor, after which the radium can then be brought into direct contact with its base.

During the year B. S. Barringer,¹ of New York, has also made two interesting contributions to the subject of radium therapy. In all, he has treated 16 cases, of which 3 were advanced and 1 early. Symptomatic cures have been obtained. This means, of course, that the patient's general condition is satisfactory and that cystoscopic examination shows the growth to have disappeared. In 3 of these 4 cases a histological diagnosis of carcinoma was made by Dr. Ewing from tissue removed with the cystoscopic forceps. The author insists that the best results will be obtained in early cases. Five of 16 cases have died, and at the time of the last report 3 were rapidly failing. Thirteen of the 16 cases were well advanced when the treatment was applied.

In another communication, Barringer² describes his technic. From 100 to 200 millicuries of radium, screened with 0.6 mm. of silver and 1.5 mm. of rubber, are put up so as to form a capsule about one inch long and about one-eighth inch in diameter. To this capsule a long, stout, double linen thread is attached and it is then passed into the bladder through a direct cystoscope. After the irradiation is over, the capsule is drawn out of the bladder through the urethra by means of the attached thread. As a large percentage of bladder carcinomas are situated upon the base, the author believes that this method, though apparently somewhat crude, is, nevertheless, a satisfactory one. If the neoplasm is situated on the lateral wall, the patient is placed upon one side while the radium is applied.

With regard to the effect of irradiation, Barringer has found that there is much variation with any given dose. As a rule, it does not change the appearance of the tumor, although the latter becomes much softer and is more susceptible to the effects of fulguration. Sometimes, however, sloughing begins very shortly after the application and persists for a considerable time, in some cases even for a number of months. The initial pain is simply that of the cystoscopy. During the treatment, patients are usually able to urinate. As the application never lasts longer than eight hours, some have preferred to hold their urine until the radium is removed. Subsequent pain may be very slight or very severe, and may last from one day to several weeks. In cases in which the sphincter is involved, irradiation may cause great pain and frequency of

¹ Journal of the American Medical Association, April 28, 1917.

² *Ibid.*, November 11, 1916.

urination, and in such cases the author advises that it be used with great caution. Likewise he advises caution in those cases in which the neoplasm is extensive and in which hemorrhage is so persistent that a satisfactory cystoscopic examination cannot be made. One such case in which a fatal rupture of the bladder occurred two months and a half after irradiation has been brought to the author's attention. He suggests that in these extensive infiltrations it may be well to expose the bladder suprapubically and determine whether the carcinoma has invaded the surrounding tissues. Under such circumstances, of course, radium would not only be useless, but probably dangerous.

Howard Lilienthal,¹ of New York, reports a case of vesical carcinoma in which the patient was well five years after operation. The case was that of a patient who had passed bloody urine containing clots and who, upon cystoscopic examination, was found to have a cauliflower mass about 2 cm. in diameter situated close to the right ureteral orifice. A suprapubic operation was performed and the mass, together with a broad area of apparently healthy tissue, was removed with the scissors, after which the cautery was applied. A small median prostatic protuberance was also burned away. The bladder was drained by a catheter passed through the urethra, the vesical wound and superjacent muscular plane of the abdominal wall closed, and the skin wound drained. Microscopic examination of the tumor proved it to be a squamous-celled carcinoma.

The bladder was irrigated every three hours, but in spite of the irrigation the patient's temperature rose to 104° on the twelfth day after operation. Rectal palpation revealed a doughy mass high up in the bowel. This proved to be an abscess, which was evacuated and drained through the perineum by means of the curved prerectal incision. As the fever failed to subside, however, another operation (extraperitoneal) was performed through the abdomen but no pus could be found. About two months after the original operation, a nephrectomy was done. It showed perinephric abscess, pyonephrosis and a pyoureter. Cystoscopic examination a short time before this operation had shown apparent healing of the wound caused by removal of the neoplasm. The prostate was removed three and a half years later on account of enlargement. It showed no sign of malignancy and there was no sign of recurrence of the tumor in the bladder.

In discussing the subject of vesical tumors, Lilienthal expresses the opinion that preliminary study of small masses removed with cystoscopic forceps may very often lead one astray, for the reason that the tissue so secured may be taken from an area of the growth that does not show malignancy. Therefore, he questions the wisdom of the application of the high-frequency currents on operable solitary tumors of doubtful nature.

Chronic Cystitis. During the year two important contributions to this subject have come to my notice. Geraghty,² of the Brady Urological Institute, in discussing vesical infections pays special attention to a form of chronic localized cystitis which he considers responsible for the per-

¹ New York Medical Journal, March 3, 1917.

² Surgery, Gynecology and Obstetrics, June, 1917.

sistence of symptoms. The appearance of the inflamed patches varies somewhat, at times being simply hyperemic, at others edematous or even bullous, while in some cases there is a distinct loss of mucous membrane with ulcer formation. The superficial lesions have been found to yield to irrigations of silver nitrate solution, which is given in sufficient quantity to distend the bladder and thus be brought into contact with all parts of the viscus. In the deeper lesions, however, in which the submucous layer and, perhaps, also the muscle participate in the morbid process, irrigations used in this manner have very little effect. Therefore, the author recommends the application of stronger silver. The bladder is distended with normal saline solution, the ureter catheterizing cystoscope is introduced, and through this a ureter catheter, without the side eye and having the end cut square, is passed in such a manner that its tip is brought directly in contact with the diseased patch on the bladder wall. Then a few minims of a 10 or 20 per cent. solution of silver nitrate is injected through it directly upon the diseased area. The excess of silver is immediately neutralized by the salt solution, so that the rest of the bladder wall is not irritated. In women the condition can be satisfactorily treated through the Howard A. Kelly air-distention cystoscope. The author states that in some cases in which the lesions seemed to be particularly rebellious to treatment, he has fused a small quantity of silver nitrate on the end of a metal-tipped ureter catheter and in this manner made an application of the pure salt. The patients treated by this means have been relieved after having undergone various forms of treatment for long periods of time. In cases in which the lesions on the mucosa seem to respond to treatment, but in which there is no amelioration of the subjective symptoms, it is reasonable to assume that the deeper structures of the bladder wall have become involved. It has been Geraghty's experience that these cases resist all forms of topical application and consequently he advises resection of the diseased portion of the bladder. He remarks that these are the lesions which Hunner has so well described. They were discussed in *PROGRESSIVE MEDICINE* some years ago under the title of "Simple Ulcer of the Bladder." The writer has had a number of cases in which there were multiple ulcers of this kind situated on the posterior wall of the bladder and thus not well adapted for resection. He states that great relief was given the patients by deep cauterization of these areas with the actual cautery, burning practically through the whole thickness of the bladder wall. As might be expected, however, he considers resection much preferable to deep burning and advises it whenever it is practicable. I should hesitate to burn such ulcers very deeply until moderate use of the cautery or electric spark had proved inefficient.

A most important paper on a special form of chronic cystitis was presented at the St. Louis meeting of the American Urological Association by the late Frederick R. Charlton, of Indianapolis, and published posthumously a few months later.¹ Charlton described in a very lucid manner a condition of localized inflammation which he had observed in the bladders of elderly women in approximately 50 cases. To this

¹ Transactions of the American Urological Association, 1916.

condition, which he considers a pathological entity, he gave the name of *cystitis senilis feminarum*. Almost without exception it affects elderly women and it likewise seems to be a disease confined to those who have borne children. The symptoms develop gradually without any acute onset and are progressive, although periods of remission, during which comparative comfort is experienced, are not uncommon. Exacerbations may be very severe, being associated with pain, tenesmus and increased frequency of micturition, the last-named symptom being nocturnal as well as diurnal and thus interfering with the patient's rest, even to the extent of causing a nervous break-down.

As to the urine content, the author stated that he had never known it to be loaded with pus and mucus to the extent of being thick and ropy, as it often is in ordinary cases of cystitis affecting younger women, and also in the old prostatitis, with whom we are all so thoroughly familiar. It may be clouded with pus and mucus and occasionally, though rarely, contains a little blood. Various bacteria have been found in it, but the author is not inclined to attribute to these any etiological role to them, believing rather that they represent an infection superimposed upon a primary alteration of the vesical tissues due to the changes incident to age. He compares it to the chronic conjunctivitis with thickened and everted lids, so common in old people, and nasopharyngeal catarrhs, to which they are likewise so frequently subject. The typical lesions are described by the author as resembling patches of measles. They may have the appearance of bullous edema or even miliary tubercles. During the remissions, the vesiculopapular elevations may assume the appearance of simple ecchymotic patches. In 2 cases the changes were found to involve the urethra as well as the bladder, and almost without exception there was associated a senile vaginitis and proctitis. The author believed that the disease process within the bladder is essentially the same as that affecting the vagina, namely, a shrinkage of the submucous tissues with atrophic disturbances in the epithelium and resulting painful erosions or ulcerations. The mucous membrane of the rectum was found to present a multiplicity of lesions, varying from small punctate erosions to large, well-defined, excavated ulcers. The lesions are more extensive than in the bladder, the tissues more deeply injected, a condition which the author thought might be due to the trauma of the impinging fecal masses, together with the greater liability to more purulent infection.

As to *treatment*, it was found that hot boric acid irrigations gave relief and the same was true of instillations of argyrol. Naturally, hygienic measures are important in the management of these cases, and the patient should be got into the best general condition possible. Strong applications, such as nitrate of silver, are deemed out of place in the treatment of this condition, as the question is one of comfortable management rather than of cure. Internally, Charlton found that 5- or 10-drop doses of pure guaiacol, given three times daily, was exceedingly beneficial, but he stated that its use was empirical.

Traumatisms. In his Hunterian lecture, J. W. Thomson Walker¹ discussed bladder affections which resulted from gunshot and other

¹ *Lancet*, February 3, 1917.

injuries of the spinal cord observed in soldiers sent back from the front. In all, he has had the opportunity of studying about 450 cases, of which full histories were obtainable in 70. Variations in the function of micturition and infection of the urinary tract constitute the most important subjects taken up in his lecture. With regard to the former, two distinct stages were observed; namely, a stage of complete retention, and a stage of periodic reflex micturition. It was ascertained that the bladder had been emptied on an average from half an hour to two hours before the infliction of the injury, so that it probably contained only a small quantity of urine when the injury occurred. A considerable quantity of urine, however, will accumulate between the twelfth and twenty-fourth hours, but, as a rule, the patient does not realize that his bladder is distended. Some patients, however, have been conscious of the distention and suffered acutely from it. The average duration of this complete retention in 30 cases was fifty-five days. It varies considerably, however, as shown by the author's statistics. Thus, in one case it lasted only for twenty-four hours and in another case persisted for eighteen months. It was said to be absent in only one case.

The second stage, that of periodic reflex micturition, also called active incontinence, succeeds the stage of complete retention, developing gradually during a transition period in which the bladder is still distended, although it regains enough of its power of contraction to expel a little urine at intervals. When this stage has become fully developed, the bladder is emptied slowly as the result of reflex action. When its capacity is reached, the detrusor contracts, the sphincter relaxes and the urine is forced out. Micturition cannot be performed at will, nor can it be inhibited. The majority of the patients whom Walker observed were unaware that they were voiding. In this stage the capacity of the bladder is variable, being anywhere from 2 to 10 ounces; so likewise is the frequency of micturition.

As to bladder sensation, it was observed that the feeling of tension was fairly well preserved in many cases, but that the sensation normally experienced in the deep urethra when the bladder is full was abolished so that the patients were unable to feel the urine flowing out.

Most interesting is the study of the vesical condition in lesions at different levels of the cord and in those involving the cervical and dorsal region. Voluntary micturition was present in a few cases when the injury was not very severe. In the more severe cases, however, complete retention was present in those in which the injury had recently been inflicted, while periodic reflex micturition was observed in those seen at later periods after its receipt.

There were 3 cases in which the eleventh and twelfth dorsal and first lumbar vertebræ had been injured, one in which the first lumbar alone was involved, and one in which the second lumbar only had been injured. In 2 of these cases there was evidence of a partial lesion of the cord. In 1 of these the patient was able to urinate; in the other, he suffered from active incontinence. In the 3 remaining cases there was evidence of a complete lesion, and in all of these the patients suffered from active incontinence. It is especially interesting to note that in not a single one

of these cases was there paralytic incontinence, such as has been produced by destroying the lumbar center in animals. In one of these cases a complete lesion of the spinal cord was found at operation. It was situated at the level of the twelfth dorsal and first and second lumbar vertebræ.

In 14 cases the chorda equina was injured. The effect upon the function of the bladder was most variable. In 3 cases of partial injury, the patients passed urine voluntarily. In 8 cases, active incontinence developed after a stage of complete retention. In 2 cases, complete retention was observed. In 1 of these cases the complete retention lasted from one week to a month, coming on after active incontinence had been established.

Infection was the most common and the most fatal complication, being present in severe degree in more than 90 per cent. of all the cases admitted to one of the hospitals. The author points out that it takes place within a few days after the injury, and attributes it to the unusual conditions in which the patients are placed, such as exposure for several hours or even one or two days after the injury, the great number of wounded to be cared for, and the difficulty in following a thoroughly aseptic technic. As might be expected, the greatest danger from vesical infection is its propensity to extend to the upper urinary tract, so that it is not at all surprising that a large number of patients eventually succumb to a septic pyelonephritis. Thus, for example, at the King George Hospital, 339 cases of spinal injury were admitted, out of which 22 were transferred, and, of the remaining number, 160 succumbed to urinary infection. Many died from acute pyelonephritis. The acute cases which the author saw were ushered in by a chill, followed by a rapid rise of temperature to 102° F., or higher. The patients complained of pain in the loins, which was usually more acute on one side, the abdomen became distended and was somewhat rigid on the side of the involved kidney, and as the condition progressed the patient became more and more septic, as evidenced by hiccough, vomiting and mental hebetude. These symptoms were superseded by low muttering delirium, coma and death. This, of course, is the common picture observed in cases of the kind in civil practice. At the base hospitals, chronic septic pyelonephritis with recurring attacks of acute pyelonephritis was not uncommon, and almost always ended fatally, the patient dying during an acute attack. When there are associated lesions, Walker states that it is at first difficult to determine the exact causes of the septic condition. In such cases he came to place the most reliance upon tenderness over the kidney and the temperature curve. Tenderness is almost an invariable symptom. The chief characteristic of the temperature is the occurrence of periods of exacerbations in which the temperature may rise as high as 104°. Such variations are not present when the fever is due to absorption from a bed-sore or other open wound.

Treatment has to do with withdrawal of the urine and the management of septic complications. With reference to the former, three methods are discussed, namely: interval catheterization, continuous catheterization, and suprapubic drainage. The first-mentioned method

is the one which has been generally adopted, a catheter being passed as soon as possible after the injury and then at regular intervals thereafter until the stage of active incontinence is established. The average time that elapsed before a catheter was passed in 46 cases was twenty-seven hours. Two patients received no attention for four days and four others lay out for three days before they could be reached. It was found that the average period during which catheterization was required was two months. Continuous catheterization has not proved at all successful. As urethritis soon develops under its use in patients who have no spinal lesion, it is not surprising that in these paraplegics such sequels as perineal abscess, urinary fistula and sloughing of large portions of the soft tissues, including the urethral walls, are prone to occur. With regard to suprapubic drainage of the bladder, the author advocates it at the earliest possible moment as a prophylactic measure. He suggests that it take the place of the catheter and that continuous drainage through the wound be prolonged until the second stage, or that of active incontinence, has become established. This will be shown, of course, by the outflow of the urine through the urethra. The author states that he has not seen a case in which this method has been tried, and while he fully realizes the lack of facilities at the casualty clearing stations, he thinks that the plan might be feasible in some cases. He furthermore expresses the opinion that no great harm would result if twenty-four or even forty-eight hours were allowed to elapse before the performance of the operation, provided, of course, that no infection had been produced by passage of the catheter at the front. The latter practice he would taboo in all cases in which suprapubic cystotomy was contemplated.

A considerable number of patients had a cystotomy done after their bladders had become infected. A double drainage tube was used in these cases, so that continuous irrigation could be practised for a few days, after which the bladder was washed out at intervals with weak antiseptic solutions, such as silver nitrate 1 to 10,000 or permanganate of potassium 1 to 5000. During the first week or ten days there was some flow of urine outside the suprapubic drainage tube, so that the use of a suction apparatus was necessary to keep the patient dry. Later, however, the wound contracted so that a rubber shield with a cannula to carry the tube was strapped on over a small piece of borated lint. In many of the cases it was found that a No. 12 rubber catheter (English scale) answered every purpose if it was connected with a bottle by rubber tubing.

The extensive experience of military surgeons in this line of work should prove of value to surgeons who are still engaged in civil practice and who only occasionally see cases of this kind. Walker's paper is very interesting and its perusal is recommended to all who care to go further into the details than it is possible to do in this review.

In 32 cases of injury of the bladder occurring in French soldiers, Leguen¹ found 10 in which stone formation took place at variable periods after the injury, and in all of these cases there had been an associated

¹ Jour. d'Urologie, March, 1917, vi, No. 6.

injury of the pelvis. Consequently the author concludes that the latter injury is responsible for the stone formation, maintaining that infection of the vesical wound will not explain the formation of calculi, inasmuch as it was present in all of the 32 cases. Injuries of this class really constitute a double compound fracture, communicating not only with the exterior, but also with the cavity of the bladder in such a manner that urine is brought into contact with the broken pelvic bones and fragments of bone are forced into the bladder. In some cases the author found such fragments forming the nucleus of the stone, and likewise found other fragments firmly imbedded in the bladder wall and perivesicular tissues. He believes that small particles of bone within the cavity of the bladder are the ones most frequently serving as nuclei about which the solids of the urine are deposited. In a previous review, mention was made of a case reported by the same author in which a lesion of the bladder communicated with a focus of dead bone in the pelvis, and this in a case in which all external wounds had long since healed. Under such circumstances the author believes that there is a predisposal to stone formation by reason of the fact that fine particles of bone may gain access to the bladder. Leguen attempted to do an operation in such cases by separating the bladder from the bone to which it had become adherent, but was obliged to abandon the procedure both times for the reason that too much traumatism would have been inflicted. Therefore, he concluded that the best thing to do was to crush the stone and wash its fragments out of the bladder, a procedure which worked well in every case in which he tried it and saved the patient the danger of an operation as well as a considerable period of convalescence.

A. Fullerton¹ also discusses the *treatment of vesical wounds inflicted by projectiles*. In wounds of moderate dimension he advises that by excision of the damaged tissue be practised and the freshened edges then brought together. Continuous catgut suture is recommended. If the wound is so large that it cannot be closed, an attempt should be made to render it extraperitoneal. In most cases of intraperitoneal injury the bladder has been completely closed, the peritoneal cavity cleaned and a drainage inserted in the rectovesical pouch. He advises against the use of the permanent catheter, preferring interval catheterization practised every four hours. The author states that most of the men at the front have practically sterile urine and believes that it is much better to allow the clean urine to irrigate the wound than to attempt other means of drainage, although in some cases he advises irrigations. After the removal of foreign bodies, the bladder is completely closed if the wound is intraperitoneal. When extraperitoneal, however, he tries to close the suprapubic wound, leaving a drain in the space of Retzius and having the patient watched carefully as to the condition of the urine and the vesical symptoms. If the bladder becomes aseptic, the suprapubic wound is reopened.

Bladder Changes Due to Lesions of the Central Nervous System. This subject has been studied by J. Edward Burns, of Baltimore, who sum-

¹ British Medical Journal, 1916, ii, 245.

marizes the results of his investigations as follows: Patients afflicted with disease of the central nervous system often suffer first with disturbances of the bladder, which bring them to the urologist complaining of such symptoms as incontinence, difficulty and frequency of micturition, pain and retention. These difficulties occur proportionately in the order named. On account of the complicated and extensive innervation of the bladder and location of the different reflex centers for the control of urination, it will readily be seen how frequently this function may be impaired as the result of lesions of the central nervous system; for example, 61 per cent. of a certain group of tabetics had incontinence. The secondary changes that take place in the wall of the bladder are demonstrated by the cystoscope and the *x*-ray. For the *x*-ray examination Burns distends the bladder with a 10 per cent. solution of thorium. Cystograms show the trabeculation of the bladder, dilatation of the ureter and the funnel-shaped dilatation of the posterior urethra. A similar dilatation of the posterior urethra was plainly seen in cystograms of dogs' bladders taken after their posterior sacral roots had been severed. Animals thus treated developed incontinence a few days after the operation, although urination could still be performed.

Cystoscopic examination showed that the bladder may be either dilated or contracted. The trabeculation also so frequently seen in the absence of any obstruction to the outflow of urine, is almost pathognomonic of disease of the central nervous system. The trigone as a rule is atrophic and the ureteral orifices frequently fail to contract as the drops of urine are expelled. They may be somewhat dilated. The internal urinary meatus may be much dilated and may show considerable impairment of tonicity, as the result of which the cystoscope can usually be easily drawn into the posterior urethra, so that the intra-urethral portion of the lateral lobes of the prostate and the verumontanum may be readily seen. This condition shows dilatation or lack of tonicity of the internal sphincter. A similar state of the bladder walls is shown by the weak outflow of residual urine or irrigating fluid. Burns believes that incontinence of patients affected with disease of the central nervous system is due in many cases at least to dilatation of the internal sphincter, thus differing from the type of incontinence due to distention of the bladder, the so-called incontinence of retention or overflow incontinence.

As might be expected, many patients presenting the symptoms first mentioned in this article are affected with syphilis. If the blood Wassermann is positive upon admission, a dose of salvarsan, varying from 3 to 6 dgm., is given each week until 4 or 5 have been taken. As a rule, mercury is given between the injections. If the spinal fluid shows a positive reaction, a cell count above normal, a positive globulin test, and if the gold chloride test shows either a paretic or luetic curve, mercurialized serum is given intraspinally once a week for four or five weeks. This treatment relieves the lightning pains and incontinence, improves the gait, lessens the ataxia and brings about amelioration of the general health. With regard to the incontinence, the author has found that in many instances it has been permanently relieved. Urethral dilatation, practised once or twice a week, has been found markedly beneficial to

these incontinent patients. The Kollman posterior dilator is considered the instrument of choice for this purpose. If the quantity of residual urine is large and the phenolsulphonephthalein elimination very low, he advises that the patient be put to bed and continuous catheter drainage be instituted. This, of course, is in keeping with the well-recognized management of such cases. Particularly interesting are the statements concerning the benefit derived from intraspinal injection of the mercurialized serum but, unfortunately, it is not stated what reactions occurred after its use. The method, introduced by Byrnes some three or four years ago, has not been extensively used. It is known, however, that severe reactions have sometimes followed its employment. The mercury content of each dose of the serum is from $\frac{1}{50}$ to $\frac{1}{25}$ of a grain of the bichloride. It is prepared by adding the mercurial salt dissolved in 1 c.c. of freshly distilled water to 12 c.c. of the patient's blood serum and then increasing the volume of the mixture to 30 c.c. by the addition of normal saline solution. It is then heated at 56° C. for half an hour, when it is ready for use. After this treatment has been completed, several months are allowed to pass and then another Wassermann of the blood and spinal fluid are taken. If positive, the treatment is repeated again.

Cystography. Herman L. Kretschmer¹ contributes a paper to this subject. As the result of his studies, he states that he has succeeded in demonstrating a sharp line of demarcation between the urethra and the neck of the bladder, thereby corroborating the view of von Zeissl, who has maintained that the posterior urethra does not take part in the formation of the vesical neck. In children variations in the shape of the bladder were shown, some being pyriform and others oval. Sex, however, did not seem to exert any influence in this respect. Displacements, such as might be due to infection of the surrounding tissues, were readily recognized. Incomplete distention was also demonstrated in the presence of pathological conditions in adjacent tissue, in lesions of the bladder wall itself, and when the technic of filling the bladder was faulty. When such defects are detected, naturally the method must be supplemented by cystoscopy; in fact it would seem that cystography should nearly always be a supplement to cystoscopic examination. The author has found that defects of filling occur particularly in the female, in whom the related vesical structures are so frequently diseased. Of especial value is cystography in detecting diverticula of the bladder, and the author likewise considers it helpful in demonstrating poor action of the muscularis in cases of papillomatous growths where the muscular layer has become involved in the neoplastic process. In carcinoma, cystography showed a defect of distention, a variation in the density of the shadow, and a diminished bladder capacity.

Enlargement of the prostate causes elevation of the bladder shadow or broadening of the vesical base. Variations from these typical pictures, however, occur, so that failure to obtain them does not exclude benign hypertrophy of the gland. It seems to me that with our present methods of detecting enlargement of the prostate, cystography will never occupy any more than a subsidiary space.

¹ Surgery, Gynecology and Obstetrics, December, 1916.

In 3 out of 10 cases in normal children, the fluid employed for filling the bladder flowed into one ureter, and in adults this phenomenon was observed in 1 apparently healthy bladder and in 4 in which there were evidences of disease. In certain cases, dilatation of the ureters was demonstrated.

Bacillus Bulgaricus in the Treatment of Infection of the Bladder. R. F. O'Neil,¹ of Boston, reports favorably upon this method of treating coccus infections of the bladder. The method was described in this review in 1914. When he first used the treatment O'Neil employed the tablet preparations of the *Bacillus bulgaricus*, but later found fresh liquid cultures preferable. Treatment was given daily and sodium phosphate was administered internally throughout its course. Particularly efficacious was the treatment in causing disintegration of incrustations upon the bladder walls. The author finds it very valuable also in preventing the formation of incrustations in urinary wounds.

Obstructions at the Vesical Orifice. Obstructions at the vesical orifice due to conditions other than adenomatous enlargement of the prostate gland have been carefully studied by Oswald S. Lowsley,² of New York, whose previous anatomical studies in this region of the body constitute one of the most thorough works that have been done in late years. The small group of subcervical tubules are the structures which so frequently enlarge to such an extent that they interfere with the proper expulsion of the urine from the bladder. In most cases a small single tumor is formed in the midline, usually breaking through the internal meatus into the cavity of the bladder. Medium-sized tumors may likewise be formed from these tubules and it is not uncommon to find them associated with extensive adenomatous enlargement of the prostate itself, so that the former may be mistaken for an enlargement of the middle lobe of the gland. Lowsley states that in such cases a careful examination of the gland, provided it be removed intact, will show a groove where the vesical sphincter has compressed the enlarged subcervical group of tubules, thus forming a line of demarcation between the prostate and the subcervical tissues. In addition to the single tumors, a number of masses have been observed which are partially divided by an unusual development of the bundles of muscle fiber and connective tissue which pass from the ureters to the musculature of the posterior urethra. The most common arrangement is a division into three distinct parts, and in fact it may be so complete that pedunculated masses are formed. The latter may securely close the vesical orifice and be projected into the internal meatus when urination is attempted. Another type of tumor formed from these subcervical tubules is the horseshoe shape, which is usually of good size and is situated at the lower segment of the internal meatus. As a rule, it gives rise to partial obstruction, although the author has observed cases in which complete retention was caused by it. Micturition is usually painful. A case is mentioned in which the prostate had been removed through the perineal route without affording complete relief, there still being a partial reten-

¹ *Annals of Surgery*, May, 1917.

² *Journal of the American Medical Association*, February 10, 1917.

tion and 12 ounces of residual urine. Upon cystoscopic examination, a horseshoe-shaped enlargement was observed at the vesical neck. It was removed by Young's punch and the patient experienced complete relief from pain, was able to project a free stream, and had less than 1 ounce of residual urine.

The subtrigonal group of tubules may likewise become enlarged and give rise to obstructive symptoms, and Lowsley reports 17 such cases out of a total of 68 cases. This condition he states almost never affects men under forty. As the trigonum becomes elevated, there is a well-defined depression or pouch behind it. The most frequent trigonal lesion is ulceration, but tumors may likewise occur, of which the author describes three kinds; namely, the low mound-shaped mass which may, or may not, cause obstruction, the pedunculated tumor which may act as a ball valve and cause complete retention, and the villous papilloma.

Other conditions mentioned by Lowsley are fibrous stricture at the vesical neck, which is a sequel of chronic inflammation or surgical traumatism, and cysts, which usually occur just within the vesical sphincter and which the author believes are due to degeneration of the subcervical tubules. These cysts have been fully described in a previous issue of *PROGRESSIVE MEDICINE*.

It would seem that there is a common symptom complex associated with these various pathological conditions. Thus patients invariably complain of a feeling of discomfort, or even pain, in the suprapubic region, experience more or less interference with micturition and have a certain quantity of residual urine. The difficulty in micturition may vary from a sensation of being unable to force all of the urine out of the bladder to an attack of complete retention, so that in the worst cases the patient may actually suffer as much as though he were affected with true hypertrophy of the prostate. If a sound is passed, it will be found that there is some obstruction at the vesical neck and the sensation that the tip of the instrument is rising over an enlargement in this region will be transmitted to the examiner's fingers. If a finger of the left hand be passed into the rectum while the sound is in the urethra, palpation will reveal the obstructive changes at the neck of the bladder. So far as an examination of the prostate through the rectum is concerned, the important lesson to be learned from it is that there is no marked enlargement. The gland may be indurated and nodular, and the examiner will usually be able to detect band-like adhesions extending from its lateral surfaces and between its base and the seminal vesicles. The cystoscopic picture, of course, will make the nature of the condition plain. In addition to the change in the configuration of the vesical orifice, hypertrophy of the musculature of the bladder wall, resulting in trabeculation, is usually seen. The author states that in order to get the best view, it will be necessary to raise or lower the eye-piece of the cystoscope according as the enlargement is situated on the trigonum or at the bladder neck. Treatment consists in dilatation with sounds, massage and instillations, a combination which seems to give relief in incipient cases. Where the process is very advanced, however, and considerable residual urine is present, the author recommends the use of Young's punch as the method

of choice. Chetwood's galvanocautery and the high-frequency current he also considers indicated in certain cases. In this connection it may be interesting to note that cases have been recorded in which severe hemorrhage followed the application of the high frequency, and infection has also been known to take place. Naturally, the current might best be applied to pedunculated growths and cysts. Furthermore, in doing a suprapubic prostatectomy, it would be quite possible to remove a mass of subcervical glands if the enucleation were carried out by breaking through the urethra and beginning the enucleation there. A similar point was brought out by Keyes, Jr., who, in discussing Lowsley's paper, remarked that if, during a suprapubic operation, a tightly grasping contracture were felt at the vesical neck, the finger should be pushed through it and the little intra-urethral sclerotic lobes removed.

DISEASES OF THE PROSTATE GLAND.

Prostatic Obstruction. One of the best papers on prostatic obstruction which has come to my attention during the year is that of Henry G. Bugbee,¹ of New York, who, while recognizing the fact that complete removal of the prostate gland is the ideal method, nevertheless attributes considerable value to other methods of treatment for certain cases. He apparently is of the opinion that prostatectomies are performed upon patients who would do equally as well if a less radical plan of treatment were adopted. He makes a plea for more prolonged study of individual cases, and expresses the belief that close observation for a considerable period of time would lessen the frequency of mistaken diagnoses. Local edema of the vesical neck, congestion of the prostate, and nerve lesions are among the conditions which the author believes to be often mistaken for true prostatic enlargement. He states that it has been a revelation to him to observe how improvement in both general and local condition takes place after patients have been put upon a restricted diet and made to adopt a hygienic regimen. Such measures, supplemented by local palliative treatment, will unquestionably save many patients from operation, or at least permit of operation being deferred for a considerable period of time without exerting the slightest ill effect upon them. Of course, as Bugbee states, such methods can be applied only to that class of patients who are sufficiently intelligent and of ample means to carry out the instructions given them. I fully agree with Bugbee that private patients, unless suffering from acute retention, are best studied in their own environment, and I have never put such patients into the hospital for more than a few days.

The author discusses the treatment of various forms of prostatic obstruction and seems to consider the so-called small fibrous prostate the most unsatisfactory form to deal with. He enumerates the various procedures, such as the use of the Young punch, the cautery applied through the cystoscope, and the high-frequency spark applied in the same manner, and very appropriately remarks that the multiplicity of methods

¹ American Journal of Surgery, 1917.

indicates their inefficiency. With reference to the high-frequency spark, with which the author has had considerable experience, he has concluded that it must be used too often and too extensively to be satisfactory in the majority of cases. He has found that the local reaction caused by its frequent application produces a great deal of irritation and also is apt to lead to infection.

For the relief of median bar obstruction, however, he states that the burning of a furrow through the elevation of the vesical outlet has proved very satisfactory, and for this purpose he considers the high-frequency spark superior to any other agent. The operation can be repeated at intervals if occasion for it arises. Some of the author's patients treated in this way nearly five years ago have remained perfectly well, and in no instance has one of them had to have a prostatectomy done. Great relief has also been obtained in inoperable cases of general adenoma, and, of those in this class so treated during the last five years, only one has needed a prostatectomy. In two others, treatment had to be discontinued because of the impossibility of instrumentation owing to the size of the prostate. The condition of some of the patients became so much ameliorated that they refused to accept the risk of a radical operation. Of course, the author admits that this method of treating general adenoma is not the method of choice. In conclusion, he emphasizes the point that the success of any of these palliative operations depends upon attention to details, faultless technic and painstaking after-treatment.

In a later communication presented at the last meeting of the American Urological Association at Chicago, Bugbee¹ described in detail the treatment of median bar obstruction by the high-frequency current. He emphasizes the necessity of making a correct diagnosis and not applying the treatment to cases of lateral lobe enlargement, constriction of the entire vesical neck, acute prostatitis, and nerve lesions. A preliminary preparatory treatment is advised, the length of which varies with the conditions present in the individual case. It consists of attention to the bowels, regulation of the diet, the administration of diuretics and urinary antiseptics, hot saline enemata, occasional catheterization, and instillations if there is much inflammation. Unless there are several ounces of residual urine or considerable inflammation present, he thinks the less local treatment given the better it will be for the patient. When the patient has been put in the best possible condition, the first application of the high-frequency current is made. If local congestion has been reduced, there is seldom acute sensation at the vesical neck, so that local anesthesia can often be dispensed with. If, however, it is necessary, novocaine in a 2 or 4 per cent. solution, with adrenalin 1 to 16,000, is considered the best. Several ounces of this solution should also be placed in the bladder and allowed to remain thirty minutes. A suppository of opium and belladonna may also be inserted into the rectum one-half hour before treatment. Bugbee states that the only cystoscope he has found satisfactory for this work is an 18 F. indirect close-vision instrument. Through such an instrument, manipulation of the fulgurating wire is not

¹ Urologic and Cutaneous Review, July, 1917.

difficult, although a deflector is necessary to hold it firmly against the obstructing bar when the current is turned on. The smallest insulated steel wire is used and its ends should be carefully adjusted before starting to cut, being brought into contact with the internal edge of the bar. The author prefers a light spark with long application rather than a heavy spark used for a shorter time. The total application may last about three minutes. As a rule, the bar is completely cut through before withdrawing the wire, this constituting the only application made at the first treatment. After-treatment consists in keeping the patient quiet for several days, opening the bowels, and rendering the urine bland by the administration of urinary antiseptics. Urotropin has been found to cause irritation in some of these cases and for that reason its use is not advised. There may be enough congestion to require catheterization once or twice. It is said that after four or five days there will be greater freedom of micturition and that flakes of cast-off tissue will be voided with the urine; later a distinct slough may be passed. A second application should not be made until the urine has become clear and is voided without irritation. At the second treatment, cuts are made at the sides of the first cut, thus broadening the furrow. It has been found that two applications will often suffice to bring about relief. After several months have elapsed the patient should be examined again, and, if further applications are necessary, they should be given. Each case is treated according to individual requirements.

So far as he has been able to determine, the median bar consisted of edematous mucous membrane; of a connective-tissue layer beneath or involving the mucous membrane; of inflamed submucous glandular tissue; of hypertrophic glandular tissue; or of hypertrophy of the sphincter. In some cases, too, there was evidence of beginning hypertrophy of the median lobe of the prostate without any enlargement of the lateral lobes and still another class was due to nerve lesions, the bar being caused rather by a dropping away of the bladder and by the formation of new tissue.

Many of the first class of patients gave a history of gonorrhea with involvement of the prostate and seminal vesicles and traced their symptoms to the time of their infection. Bugbee expresses the opinion that, in such cases, the new tissue is inflammatory in origin, perhaps being an extension of chronic peri-urethritis, prostatitis and vesiculitis. Such a process might result in proliferation of the mucous membrane at the apex of the trigonum or in the formation of connective tissue in the parts beneath the mucosa. In some of these cases he believes that fibrous infiltration has resulted from traumatism due to instrumentation. I have also seen cases of this type in which I attributed the obstructive lesion to the same cause. He likewise expresses the opinion that continuous irritation set up by small quantities of residual urine which had become infected may produce a similar result. Among the first 25 cases of median bar obstruction which the author reported there were 13 of this inflammatory type.

The author again gives expression to the opinion that it is only in median bar cases that the high-frequency spark will prove curative.

Further experience has also led the author to prefer the punch operation in the treatment of obstruction due to fibrous ring formation at the neck of the bladder. He removes from four to six pieces of tissue at different points, laterally and anteriorly as well as posteriorly, and states that his results have been very satisfactory. The spark treatment is not advised for dispensary patients because of the usual lack of coöperation on their part and also because it is not possible to give them the preliminary treatment required and to keep them under observation afterward.

Alexander Randall¹ has also studied the gross pathological characteristics of median bar formation in 54 subjects in whom it was found at autopsy out of a total of 300 subjects examined. Of these 54 cases, there were 18 which he classified as large bars, by which was meant that the condition found was such that it must have caused urinary obstruction and retention during life, and that the size of the bar and the damage to the urinary tract above it stood out as a marked abnormality on examination of the specimen. In the remaining 36 cases, bar formation of lesser degree was found. In this class neither the size of the bar itself nor any other changes in the urinary tract indicated that interference with the passage of the urine had taken place. As to the structure of the bars, the author divides them into two principal groups, fibrous and glandular. The former consisted of a connective-tissue fibrosis, which formed a well-defined bar across the posterior vesical orifice. Microscopic examination of this tissue showed it to be of an inflammatory nature and there was also chronic inflammation of the prostate gland itself which presented areas of connective-tissue formation. This type of bar the author subdivided into two varieties according as the sclerosis caused shortening of the urethral or trigonal surface. In the former, the verumontanum was brought nearly to the vesical lip; in fact, in some subjects it lay directly under the bar. In the other variety the trigonal surface was shortened and presented a transverse crease, the ureteral orifices being brought nearer to the neck of the bladder. The glandular type of bar was found to be due to glandular hypertrophy, which developed either in the posterior prostatic commissure under the sphincter muscle within the prostatic capsule, or was confined to the subcervical glands of Albarran situated beneath the mucous membrane of the vesical outlet. This rarely formed a distinct bar, rather assuming a nodular form with deep clefts on either side.

Preparatory and Postoperative Treatment. The methods of preparation used at the Brady Urological Institute have been fully described by Young and Frantz.² Before the functional renal tests were placed upon a trustworthy basis, it was customary to base the decision to operate, or not to operate, upon a careful physical examination of the patient, the amount of residual urine found, and the evident signs of good or bad renal function.

Since 1910, however, the phenol-sulphonephthalein test has been applied to these cases with most satisfactory results, and the authors are convinced that it furnishes an accurate index of kidney function.

¹ Transactions of the American Urological Association, 1916.

² Journal of the American Medical Association, February 17, 1917.

From time to time other tests have been added as a matter of routine, so that at present those for determining the blood urea and the retention of acid salts in the blood are invariably employed. With reference to the latter, it is stated that a fair index of acidosis is furnished by the amount of sodium bicarbonate required to render the urine alkaline. In a normal subject, 10 grams will bring about this reaction within a few hours.

The circulatory apparatus is studied by an internist, who is attached to the Institute and who manages the medical treatment of all patients. There is nothing new in the methods employed in treating patients with cardiac lesions; rest in bed, digitalis and free catharsis are the sheet anchors. Limitation of the intake of fluids is advised if there is edema.

The presence of a large quantity of residual urine, even though the renal function is good and there is no vesical infection, is considered a contra-indication to immediate operation, so that preliminary treatment is always given patients thus affected. Catheterization is instituted and, after the relaxed bladder regains some of its tone and good drainage has been secured, the operation is undertaken. The mere presence of bacteria in the urine without localizing signs of infection is not alarming, but the occurrence of an acute inflammatory process requires prompt attention. Should urethral infection or epididymitis occur during the use of the retention catheter, the latter must be removed immediately and the bladder emptied by interval catheterization, followed by irrigations. Instillations of a 5 per cent. solution of argyrol are also recommended.

In a series of 94 cases in which prostatectomy was performed, only one death is reported, the fatal case being that of a man, aged ninety-three years, who died of cerebral hemorrhage on the thirteenth day after operation. These operations were done during the year 1915. Every patient who came to the hospital with pronounced obstruction from prostatic enlargement was operated upon, so there was no selection of cases. In 53 cases considerable preparatory treatment was employed, the longest being for a period of sixty days. Finally, the authors set forth the proposed advantages of the perineal operation, which are summarized as follows:

The wound is extravescical, the drainage dependent, and the absorption of septic materials less. Abdominal distention and other complications are much less frequent than after the suprapubic operation. Moreover, the ease with which hemorrhage can be controlled, either by ligation of bleeding vessels or packing, furnishes an additional good reason for operating through the perineum. The authors state that they believe the choice of operation has always as much to do with the ultimate result, particularly the mortality, as does the preliminary treatment, and for this reason they call attention to the value of the perineal operation as performed at the Brady Institute.

Pilcher,¹ who still does the operation in two stages, employs local anesthesia in the preliminary suprapubic cystotomy, using a fifth of

¹ Surgery, Gynecology and Obstetrics, February, 1917.

1 per cent. novacaine solution for infiltration of the skin and deeper tissues, and also infiltrates the bladder wall. In addition to these measures, for the purpose of securing more lasting anesthesia, he injects a quarter of 1 per cent. solution of quinin and urea hydrochloride into the muscles, the perivesicular tissues and the fascia superjacent to the peritoneum. These methods suffice to render opening of the bladder painless, no anesthetic solution being injected into the bladder itself. The latter is filled with sterile water, however, just before it is opened, provided that a catheter can be easily passed through the urethra.

Pilcher is very careful in the technic of this preliminary operation, laying great stress upon the importance of a clean division of the tissues, protection of the peritoneum, wide exposure of the anterior surface of the bladder and fixation of its walls before it is opened. The anterior wall of the bladder is freed by passing the index finger, covered with gauze, directly under the symphysis pubis and cleaning the tissues from either side and above and also carrying up the reflected fold of peritoneum. The drainage tube is inserted into the uppermost angle of the wound and securely fastened in with sutures, the different layers of tissue being closed layer by layer. Self-retaining tubes, similar to Pezzer catheters, are employed. Very rarely has the author been obliged to supplement this method of infiltration anesthesia with a general anesthetic, and his patients have neither experienced pain during the operation nor suffered from shock afterward. They are allowed to get out of bed at the end of twenty-four hours. It is interesting to note that for enucleation of the prostate, Pilcher employs ether given by the drop method. In discussing the question of anesthesia in prostatectomy I have often made the statement that in my opinion there are very few patients who cannot take ether after proper preparatory treatment, provided, of course, that it is given by an experienced anesthetizer. Crenshaw,¹ in a recent paper, states that ether is used at the Mayo Clinic. Pilcher states that he never uses spinal analgesia in these cases and makes no mention of gas and oxygen, which seem to be much in favor with certain surgeons.

There are many interesting points in connection with the enucleation of the prostate and postoperative management of the cases as conducted by Pilcher. Thus, for example, when the condition of the patient is such as to make the performance of the enucleation possible within one or two weeks after the preliminary operation, he finds it unnecessary to use any instrument to enlarge the opening already present in the bladder. Where the interval between the two operations is longer, however, he resorts to three radiating incisions, one on each side of the original opening and the third extending downward from it. They are carried only as deep as the anterior sheath of the rectus muscle, and have been found to give easy approach to the interior of the bladder. As a rule, the author employs the intra-urethral method of enucleation; but for the removal of those enormously enlarged prostates which seem to be affected throughout their substance, with the

¹ Journal of the American Medical Association, February 24, 1917.

exception of the median lobe, he has found enucleation to be more easily accomplished by passing the finger between the sphincter of the bladder and the tumor, and carrying it completely around the latter. For the control of hemorrhage, he uses a hemostatic bag, as devised by Hagner, of Washington. A modification of Hagner's bag permits drainage through the urethra, there being a catheter-like tube attached to its distal end. Gauze packing has not been altogether satisfactory in the author's hands.

Since June, 1914, James A. Gardner¹ has done the two-stage operation, having been converted to it by Pilcher after he had reflected upon the loss of some patients who seemed to be fair surgical risks. During the last three years he has operated upon 81 patients by the two-stage method without any mortality. The average age of the patients was slightly above sixty-five years, the oldest being eighty-five and the youngest fifty-four years old. Many of them were suffering from the effects of urinary back pressure, were poorly nourished and exhausted from loss of sleep and the disturbance due to frequent urination. For the most part they had already entered upon catheter life and had infected bladders. Nine of them had stone in the bladder. Gardner's technic is practically the same as Pilcher's. He uses local anesthesia for the preliminary cystostomy and general anesthesia for enucleation of the prostate. After enucleation, the large Marion tube is used. If the urine clears up by the third day, the tube is removed and a large Pezzet catheter is substituted for it. If packing is used for the control of hemorrhage, its removal is begun at the end of twenty-four hours. That which is loose easily comes away, being taken out and cut off, and the procedure repeated every few hours until the entire quantity has been removed. In closing the wound, figure-of-eight sutures of silkworm gut are used, the ends of those next to the drainage tube being left long, so that the wound can be drawn together after the large tube has been taken out and a smaller one inserted in its place. The author comments upon the comfort which the patients experience as the result of being thus kept comparatively dry.

Another important contribution to the subject of *postoperative care* has been made by J. Bentley Squier,² of New York. He does not irrigate the bladder for at least twenty-four hours after the operation, believing that it is better not to disturb any clot which may form, and for the same reason he does not resort to the use of any suction apparatus. Small quantities of water are given by mouth as soon as post-anesthetic nausea has subsided, and the author states that he has found hot water to be much better borne than ice-water, or even cold water. The bowels are opened by a dose of castor oil thirty-six hours after the operation. If the oil is not effectual within six hours, a high saline enema is given. As a rule, only one dose of $\frac{1}{4}$ of a grain of morphine is required to relieve pain. In common with many others, Squier has found that the critical period occurs between the twenty-fourth and the seventy-second hours after the operation. If, during this

¹ American Journal of Surgery, May, 1917, xxxi, No. 5.

² Journal of the American Medical Association, February 24, 1917.

period, there is persistent nausea or beginning hiccough, stomach lavage and the administration of castor oil through the tube, followed shortly after by high colonic irrigation, will often serve to tide the patient over the danger. Squier has observed rapid improvement after the use of these measures. When these prodromal signs of uremia come on, he believes that much valuable help may be obtained by having a chemical examination of the blood made, placing great reliance upon the degree of retention of urea, uric acid and creatinin. The test for the last-named substance was given in this review some years ago. In health, it is found only in very small quantities, from 1 to 2 mg. per 100 c.c., but may go as high as 15 mg. when uremia is imminent.

In cases which progress satisfactorily for twenty-four hours, bladder irrigations of warm boric acid solution are employed, the number varying according to the condition of the patient. Where there is much cystitis five or six are given during the course of the day. The cigarette drain in the space of Retzius is taken out at the end of the second or third day, but the intravesical drainage tube is not removed until the fourth day, and sometimes not until the fifth or sixth, according to the condition of the bladder. The three factors taken into consideration are the degree of vesical inflammation, the amount of oozing, together with the formation of clots, and the degree in which granulations are forming around the tube. Squier rightly considers it essential that a well-defined fistulous tract shall have formed before the tube is taken out, so that there may be no infiltration of urine into the contiguous tissues. If the urine is alkaline, 10 grains of urotropin and 5 grains of acid sodium phosphate or sodium benzoate are given four times a day. No instruments are passed through the urethra until at least two weeks after the operation, and frequently not for three weeks, and the author warns against the early use of urethral instruments, which he points out are almost without exception harmful. He remarks that the early passage of steel instruments has resulted in the dislodgment of clots from the perivesicular plexus, which may very quickly cause death once they get into the general circulation. Furthermore, he attributes epididymitis to mechanical injury inflicted by the passage of instruments. Unfortunately, there is good reason for sounding a note of warning with reference to this matter, for some whose position would naturally lead one to assume that their judgment would be better still resort to such meddlesome instrumental interference. Squier allows his patients to sit up in bed in six or seven days, but does not allow them to get up and about until ten or twelve days have passed. He says, "Keep the patient interested and alive mentally, make his surroundings pleasant, but by no means start him doing stunts that might not even be appropriate for a person thirty to forty years younger."

Squier's experience with the lactic acid bacilli in cases in which phosphates are deposited around the margins of the wound has been very satisfactory. In patients in whom the bladder had been overdistended and impaired as to its muscular function, he advises that the supra-

pubic fistula be allowed to remain open for a considerable time, believing that prolonged drainage thus secured will do more to restore lost tone than any other therapeutic measure.

Special importance is laid by the author upon securing nurses who have been specially trained in the management of these cases. He states that in his early experience he had great trouble in getting women of a high type to care for his prostatic patients, as they seemed to think it beneath their dignity to nurse a genito-urinary case. He finally succeeded, however, in getting a number of very competent nurses to take up this line of work and, fortunately, the original corps has been added to year by year, so that now he has a very goodly number available for cases of this kind. In this respect a contribution from the Mayo Clinic recently published by John L. Crenshaw¹ is of interest. It seems that the experience with women nurses in this large Clinic has not been at all satisfactory. The women had little previous training, disliked the work, and seemed bored by the complaining and often fractious old men; in fact, according to Crenshaw's statements, they did not consider anything short of a hemorrhage or an embolus a complication worth reporting to the surgeon on duty. For this reason male nurses were introduced into the Clinic for the special care of prostate and bladder cases. Apparently the change has been a good one, for it is stated that at the present time it is rare for a wound to have any odor and that the patients may occupy any room in the hospital instead of being herded together in a certain quarter. Certainly the question of nursing is an important one, for anything that can be done to make these old prostatics clean and comfortable should not be left undone. I well remember hearing nurses refer to the quarters of such patients as "ammonia factories," and at times have not hesitated to say to them that the degree of ammoniacal odor was in direct ratio to the incompetence of the nurse—the stronger the one the greater the other.

Crenshaw likewise explains the postoperative treatment in vogue at the Mayo Clinic. There, too, water is given by the mouth as soon as the patient recovers from the anesthetic and, as a rule, only a single dose of morphine is administered. Irrigation of the bladder is resorted to at first only sufficiently often to keep the tube draining, and a two-ounce syringe is used so as to do away with any chance of overdistending the bladder and thereby defeating the very object for which the irrigation is given. In conformity with their usual custom of getting patients out of bed rather earlier than many surgeons, the Mayos likewise get their prostatic patients up on the third day, and, as Crenshaw states, "earlier if indicated." Of course complications necessitate a longer stay in bed. The bowels are opened by Epsom salts on the third morning. The tubes are left undisturbed until the fifth or sixth day, which seems to be about the right time for removing them according to the experience of many surgeons.

Pyelonephritis has been the most common serious complication in the Clinic. Its prevention consists in keeping the prostatic bed, the

¹ Journal of the American Medical Association, February 24, 1917.

bladder and the external wound scrupulously clean, in giving an abundance of liquids, and administering urotropin and acid sodium phosphate from the third day after the operation. Fifteen grains of each of these drugs are given every four hours.

Secondary hemorrhage occurred most frequently from the fourth to the seventh day, usually in patients who were otherwise doing very well. It is treated by removing all tubes, giving a hypodermic injection of morphine to quiet the patient, applying an ice-bag and making pressure upon the perineum. Crenshaw states that in the last six years there has been but one serious secondary hemorrhage following prostatectomy. This case did not respond to the usual methods of treatment and the patient became pulseless and unconscious. Transfusion of blood, however, revived him and he made an uneventful recovery.

At the last meeting of the American Surgical Association, John B. Deaver,¹ of Philadelphia, discussed the subject of prostatectomy with *reference to preparatory treatment, operative technic and postoperative care*. In cases in which the obstructive symptoms have been present only a short time and in which the general condition of the patient is good, he operates as soon as the routine functional tests have been made and the effects of cystoscopic examination have subsided. In cases further advanced, in which the most prominent symptoms are increased frequency of micturition, pain and hematuria, he employs preliminary interval catheterization until the functional capacity of the kidneys is improved, and then proceeds to enucleate the gland. Continuous catheterization has been superseded by suprapubic drainage, except in certain cases in which even this simple operation is contra-indicated and also in cases in which it is thought better to bring about a slow reduction of back pressure. The two-stage operation is employed if catheterization fails to bring about amelioration of the kidney function and improvement of the general condition. The preliminary drainage of the bladder is usually kept up for two weeks. Ether is considered the best anesthetic. Spinal analgesia is considered very dangerous. Squier's method of beginning the enucleation through the roof of the prostatic urethra is employed when the most prominent nodules project into the lumen of the canal, but when the projection is principally into the bladder, Freyer's method of beginning enucleation from the vesical aspect of the mass is considered preferable. In many cases Deaver makes a circular incision through the mucous membrane and the overlying prostatic sheath around the vesical orifice of the urethra and carries enucleation through this incision. He believes that irregularity of the mucous membrane, which may give rise to obstruction later, can be prevented by enucleation through such an incision. I first saw this method employed by Theodore Kocher, in 1909, and have used it a number of times with good results.

For the control of hemorrhage, Deaver places a purse-string or over-running suture of catgut in the mucous membrane forming the margin of the cavity and then packs with a single strip of gauze, bringing the

¹ Transactions of the American Surgical Association, 1917.

distal end out through the incision in the bladder wall beside the drainage tube, then draws the suture taut and ties it around the tube and gauze pack.

In discussing suprapubic and perineal operations, the opinion is expressed that in the hands of the expert, one operation is as safe as the other, but that, for the less experienced operator, the suprapubic route is the safer of the two.

The methods followed by Pauchet have been described by B. Sherwood Dunn.¹ This surgeon likewise attributes the better results that he has obtained of late years to the improvement in preparatory treatment. For the estimation of kidney function he employs the methylene-blue test and Ambard's constant. He also uses the two-stage operation in certain cases which for any reason impress him as being poor surgical risks. Certain technical points are considered important, such as the avoidance of extensively separating the bladder wall from the fat in the space of Retzius, which the author believes predisposes to cellulitis; the division of the vas deferens for the purpose of preventing epididymitis in cases of feeble old men with badly infected bladders, and the prompt packing of the prostatic cavity with a single long piece of gauze in any case which shows a tendency to bleed. Pauchet has performed 400 suprapubic prostatectomies. In the first 100 the mortality was 10 per cent.; in the second, 8.1 per cent.; in the third, 6.5 per cent.; and in the fourth, 4 per cent.

LOCAL ANESTHESIA. In previous reviews, prostatectomy under local anesthesia has been discussed. Among the number of contributions to be reviewed was that of Legueu, which was published some three or four years ago. In a more recent paper,² this author gives further data concerning his experience with the method. He reports 150 operations, describes his technic and states his results which he considers to be excellent. Naturally, his technic has undergone some modification as he has become more experienced with the method. As practised at present, it is substantially as follows: A hypodermic injection of morphine is given to the patient before the operation, and from 40 to 50 c.c. of a 0.5 per cent. solution of novocain, to which adrenalin is added in the proportion of $2\frac{1}{2}$ drops to each 50 c.c., is injected into the bladder. No attempt is made to anesthetize the bladder wall itself after the skin and space of Retzius have been infiltrated by the above-mentioned solution. After the bladder has been opened, two fingers of the left hand are passed within to serve as guides for the long, curved needles with which a series of infiltrations are made around the enlarged prostate. The first of these injections is sometimes painful, but the last is hardly felt. In this manner the circumference of the enlarged prostate, the space between the rectum and the prostate behind, and also the anterior segment of the internal meatus are anesthetized. The operation is begun as soon as the infiltration of these tissues is completed, and a special point that the author makes is that it is not necessary to wait several minutes before beginning the enucleation. The quan-

¹ American Medicine, February, 1917.

² Jour. d'Urologie, March, 1917, vi, No. 6.

tity of fluid employed averages 250 to 300 c.c., including that injected into the bladder.

The author states that he has never seen any bad effect, either immediate or remote, from the use of novocain. In some of his earlier cases, as stated in his previous report, sloughing took place in the bed of the prostate, a sequel which the author concluded was caused by too strong a solution of adrenalin, and it was for this reason that he reduced the quantity from 25 to 5 drops to each 100 c.c.

In the 150 operations the mortality rate was 5 per cent., which was somewhat lower than the percentage obtained by the author in 450 cases previously done under general anesthesia. Without disregarding the possibility that this reduction may have been due in part to greater experience in the management of his cases, the author, nevertheless, believes that the better results can justly be attributed to the method of local anesthesia. He states that in another series of cases, the number of which, however, is not given, in which he was obliged for one reason or another to use chloroform, the mortality was 10 per cent. He is of the opinion that local anesthesia will save 5 or 6 per cent. of patients who would die if they were given a general anesthetic. Among patients who probably could not have taken a general anesthetic are mentioned a number who were suffering from aortic lesions, several with chronic bronchitis, and one with emphysema.

In two classes of cases, however, the author considers local anesthesia absolutely contra-indicated; namely, those in which there is excessive hyperesthesia of the bladder, resulting either from a high degree of cystitis or from stone, and in cases of fibrous sclerotic prostate. In the first class, sensibility of the bladder cannot be overcome by local anesthesia, not only the injections themselves being very painful, but every manipulation equally so. In the latter class, as there is no determinable plane of cleavage between the prostate and periprostatic tissues, it is practically impossible to secure an anesthetic zone, as one does not know where to make the injections. Wherever there is an adenoma to be enucleated from a bladder not abnormally sensitive, then the method will give, according to the author's experience, a perfect result with regard to the performance of the operation and post-operative sequels. The author considers his method of inducing local anesthesia the best thus far devised.

Eosinophilia. In this review four years ago reference was made to some studies carried out by Leguen and Morel concerning *eosinophilia in hypertrophy and carcinoma of the prostate*, the authors maintaining that in the former condition there was an increase in the eosinophiles which averaged 5 per cent., whereas in the latter their percentage was reduced to below normal to an average of 0.04 of 1 per cent., there being at the same time an increase in the polymuclear neutrophiles. Further studies,¹ based upon more than 150 cases of prostatic disease, have led the authors to conclude that an examination of the leukocytes will give definite information as to the nature of the affection in 75 to 80 per

¹ Journal d'Urologie, March, 1917, vi, No. 6.

cent. of the cases, thus leaving about 25 per cent. in which nothing can be learned from the blood picture, and they now have a blood examination made as a matter of routine in all cases, believing that it will prove especially helpful in those cases in which there is doubt as to the nature of an apparent neoplasm. It is to be borne in mind that occurrence of infection, an attack of fever, a hemorrhage or the institution of drainage may modify from day to day the leukocytic picture, but after the termination of any of these extraneous conditions the percentage of eosinophiles will be found to correspond to that first observed. A table is appended to show the variations due to such influences in a number of cases.

Prostatic Calculi. This subject is discussed by Walter M. Brickner,¹ of New York, who excludes those calculi which are found in the prostatic urethra, and which may originate higher in the urogenital tract, and confines himself to a discussion of those formed in the prostate itself. As regards the latter, they are usually multiple and of small size, although a single, fairly large stone may be formed. The corpora amylacea may act as nuclei upon which carbonate and phosphate of lime are deposited and thus cause true prostatic calculi. Owing to the presence of concretions, inflammatory changes take place which sometimes may progress to suppuration. As to symptoms, there may be dysuria, frequency and pain. The urine is turbid. Pain is a very common though not a constant symptom. It may be of a continuous aching character or, as more frequently happens, remittent. It may be referred to the perineum, testicle, end of the penis or inguinal region. Sometimes it is aggravated during stool. If a calculus projects into the urethra or bladder, then there will usually be a terminal hematuria. In some cases it would seem that the subjective symptoms are not severe. Thus, in a case of the author's in which one of a large number of prostatic stones projected into the urethra, the only symptom was pain in the glans when the bladder became distended. This pain was relieved by urination which was not accompanied by any distress. There was no hematuria and no discharge, and the urine contained only a few pus cells. In other cases there has been considerable urethral discharge. Examination through the rectum may reveal an enlarged and nodular prostate, very tender to palpation. Crepitation may be elicited and is pathognomonic of the condition. Stones projecting into the urethra may be diagnosed upon the passage of a metal sound, but the sensation which they impart is one of surface contact only, in contradistinction to the click which is given by a vesical stone. The *x*-ray is most valuable in making the diagnosis. The author states that if the shadows are small, numerous and discrete, it is a fair presumption that they are produced by prostatic rather than by vesical stone. Such small shadows, however, may be so fused together as to look like a single large vesical stone. The author lays down the following rule for differentiating the two: If an *x*-ray picture of the unemptied bladder, taken with the patient in the level, supine or reversed

¹ Urological and Cutaneous Review, February, 1917.

Trendelenburg posture, gives a shadow or group of shadows at the vesical neck, and another picture taken with the patient in the Trendelenburg position, the x-ray facing in the same relative direction, shows the shadow in the same place as before, the stone or stones are in the prostate or the prostatic urethra or in a diverticulum behind the prostate. Furthermore, the author believes that assistance in differentiating the shadow may be obtained by making an exposure on a flexible film passed into the rectum in a thin, hard rubber or wooden cylindrical speculum. Such a film lies closer to the stone than a plate under the buttocks and, therefore, should give a sharper outline. Of course, a cystoscopic examination will reveal whether there is a stone in the bladder and it is a means which should not be neglected. As to treatment, a single stone or small group of stones may be removed by a perineal prostatotomy. In cases in which they are more numerous, a partial prostatectomy may be required, preferably through the perineum. If there is reason to believe that a stone projecting into the urethra is the only one present, an effort should be made to remove it through the operating cysto-urethroscope.

DISEASES OF THE PENIS AND URETHRA.

Venereal Granuloma. This is a form of venereal disease occurring in tropical countries and was probably first described by MacLeod and Maitland, who observed it in India, under the title "Serpiginous Ulceration of the Groin or Groin Ulceration." Although similar cases were reported from time to time by different authors, several years elapsed after the observations of these military surgeons before Conyers and Daniels, in 1896, published a description of 9 typical cases which they had studied in British Guiana. Their monograph contained a number of photographs, which proved helpful to others who subsequently studied the disease. All of these cases occurred in negroes. Before the work of Conyers and Daniels, the opinion was generally held that venereal granuloma was of a syphilitic nature, and to these observers is due the credit of first definitely separating it from syphilis. They, however, expressed the erroneous opinion that it was an infection which closely approximated lupus erythematosus. Others were equally wrong in that they believed it might be of a tuberculous or epitheliomatous nature. Cases were reported from the East Indies, the Fiji Islands, the New Hebrides and the West Coast of Africa. As observations continued to be made, it was found that whites, as well as blacks, and members of the yellow race were susceptible.

This disease is distinctly venereal and is usually transmitted through coitus, although cases are on record in which extragenital lesions have developed; always, however, as the result of direct inoculation from the specific lesion.

The etiology of venereal granuloma has been a subject of keen discussion, especially during the last few years. In 1909, Cleland and Hickinbotham found in the lesions a spirochete, much shorter and larger than the *Spirocheta pallida*, to which they gave the name of

Spirocheta aboriginalis. Later, in 1911, McLean found the same spirochete in cases which he studied in Australia, and was of the opinion that it was probably the cause of the disease. In 1913, Sabella found another type of spirochete resembling the *Spirocheta pertenuis*, although he was very doubtful as to the etiological role it might play. He was rather inclined to the opinion that the disease was a very late form of frambesia. Another opinion was expressed at about the same time by Genrich, who attributed it to the streptobacillus of Ducrey. His observations were merely of a comparative nature, inasmuch as he based his opinion upon the similarity between serpiginous chancroid, which he was studying at the time, and venereal granuloma as described by Martini and Grindon. Others, notably Crocker, inclined to the opinion that the disease was simply a staphylococcic infection which assumes a peculiar virulence in the black race, although Crocker did not doubt its typical occurrence in whites who have cohabited with infected blacks. In 1905, Donovan described an encapsulated bacillus closely resembling the *Bacillus pneumoniae* of Friedländer and the *Bacillus rhinoscleromatis*, and which also presented some resemblance to other encapsulated bacilli. In 1912, a bacillus corresponding in every way to the one first described by Donovan was isolated by Aragao and Vianna, who gave it the name of *calymmato bacterium granulomatis*. It would seem that this is the causative agent of the disease. In a very recent monograph, H. C. de Souza Araujo¹ describes in detail the method of cultivation of this bacillus, its staining reactions, its morphology and the results of animal inoculation which he obtained with it. The microorganism is obtained preferably from the borders of the ulcers with a small curette or scalpel, is fixed by heat or absolute alcohol and stained with Giemsa's solution. Its presence in lesions thus demonstrated is considered proof positive of their specific nature. Its cultural characteristics are not apposite to a practical review of this kind.

In regard to animal experimentation, it will suffice to say that the experiments were generally unsatisfactory.

De Souza Araujo also discusses the pathology, symptomatology and treatment of the disease. The initial lesion may occur as a papule, vesicle, or nodule, which increases in size by extending along the subcutaneous plane of tissue. The nodular type does not develop so rapidly as the papular or vesicular. Its extension is progressive, however, in all these forms, and as the disease is auto-inoculable new lesions are wont to develop by contiguity. In the course of time several may thus coalesce, forming large papillomatous masses. With the progressive extension of the lesions, healing may take place in the older ones, so that scar-like masses are formed. The active lesions are of a bright red color, bleed easily, and secrete a thin sanguineous fluid of a very fetid odor. Naturally, the granular appearance is most pronounced on the edges, where the disease is the most active. As might be expected, the initial lesion usually occurs on the glans penis in the male and on the vulva in the female. The neighboring regions, how-

¹ Granuloma Venereo, Trabalho do Instituto Oswaldo Cruz, Rio de Janeiro, 1917.

ever, are invaded as the morbid process extends, so that the groins, perineum, buttocks and suprapubic regions, and in some cases even the thighs, become covered with granulomata. The duration of this disease is very long and cases of ten, twelve and even fourteen years' duration are reported, patients who have been affected so long being rendered helpless as the result of the large area of tissue involved and the constitutional symptoms which eventually develop. The latter consist of weakness and cachexia. Invasion of deep structures may take place, so that important viscera and bloodvessels may be opened. Thus, according to Hoffman, a very frequent cause of death is a suppurative peritonitis caused by secondary infection of the deep lymph channels. It is interesting to note that the causative organism itself does not invade the lymphatic system unless there is an associated syphilitic infection. De Souza Araujo groups his cases into three principal classes; namely, ulcerating, hypertrophic and mixed, which he subdivides into the serpiginous and the non-serpiginous. Each subdivision of the ulcerating form is further differentiated according as its edges are elevated or non-elevated. In like manner the subdivisions of the hypertrophic form are further differentiated, according as they are of the fungous or papillomatous type. The mixed form resembles the hypertrophic so far as the external surface of the body is concerned, and the ulcerating form as concerns the natural cavities of the body which are lined with mucous membrane, such as the vagina, mouth and rectum. Naturally, this form applies to lesions affecting both the surface of the body and its internal cavities in the same individual. The author found it impossible to determine a period of incubation. Some subjects said that the initial lesion had developed a week after exposure; others, two weeks, and one, a month. Some attributed it to the bites of mosquitoes or other insects, but the author remarks that their statements could not be depended upon, for they all gave the history of suspicious intercourse.

The diagnosis he considers very easy if the existence of the disease be borne in mind (as, of course, it is by physicians who practice in the countries where it is common), the physical characteristics of the initial lesion of granuloma being sufficient to permit a prompt diagnosis being made. Likewise, in the second stage clinical diagnosis should be very easy in any of its ordinary forms, and even in the abnormal forms, which are of very infrequent occurrence. The clinical diagnosis, however, should always be supplemented by a microscopic examination of tissue removed from the edge of the granulomatous ulceration and, according to the statements of de Souza Araujo, the presence of the calymmatobacterium will not leave a shadow of doubt as to the nature of the disease. In all his cases it was found. He also advises that Wassermann tests be made as a matter of routine, not only for the purpose of verifying the diagnosis of granuloma, but also in order to determine whether there be an associated syphilitic infection. With our modern methods of treatment, he considers the prognosis always good except in very advanced cases. Of course, tissue that has been destroyed cannot be replaced by normal tissue, but healing of the lesions can be effected.

Tartar emetic is considered a specific. This drug was first used for the treatment of venereal granuloma by Aragao and Vianna, who published the results obtained with it in 1913 and 1914. They first administered from 60 to 120 c.c. of a 1 to 100 solution but, after noticing that the drug seemed to be innocuous, they decided to give a smaller quantity of a stronger solution, and eventually fixed the dose at from 5 to 10 c.c. of a 1 per cent. solution. Others have varied the dose both as to actual quantity of the drug itself and the strength of its solution. De Souza Araujo and his associates have treated 25 patients by this method and have obtained excellent results. Out of the number, however, there were 3 relapses and 2 deaths, the latter occurring in patients who had had the disease a long time. Other authors, among whom may be mentioned Low and Newham,¹ and Bonne,² have also reported excellent results; the former report one case; the latter, three. Low and Newham's case is especially interesting. It was that of a white man, aged thirty-six, who had served eight years on the gold coast of Africa with the usual leaves of absence. There was nothing of importance in his past history. Early in 1916, when in Africa, he had intercourse with a black woman, a stranger of whom he knew nothing and whom he did not see again. Two days afterward he noticed a small sore on the under surface of the glans near the frenum. It was treated with mercurial washes, which seemed to do little good, although $4\frac{1}{2}$ months later the original sore was apparently healed. Six weeks later, however, after he arrived in England, another lesion appeared on the site of the previous one. The diagnosis of syphilis was made and an intensive salvarsan and mercurial treatment was given, but it had not the slightest effect. The ulceration became larger and two other sores developed, one on the glans just below the meatus and one on the skin of the penis a short distance behind the glans. The authors were asked by Mr. Cantlie to see this patient and at once recognized the nature of the trouble. The patient was removed to the Albert Docks Hospital for Tropical Diseases and the tartar emetic treatment begun. On May 1, 1 grain of the drug, dissolved in 2 fluidounces of normal saline solution, was injected intravenously. Two injections a week were then carried out until twenty-six in all had been given. The injections were always well tolerated and, apart from a pronounced feeling of lassitude on the day they were administered, no noticeable symptoms were produced. There was no elevation of temperature at any time. In all, $53\frac{1}{2}$ grains of tartar emetic were required to effect a complete cure. The quantity administered at each injection varied from 1 grain to $2\frac{1}{2}$ grains. After $43\frac{1}{2}$ grains had been given, the treatment was discontinued, but as a small unhealed place remaining at that time looked as though it might break out again, 4 more injections of $2\frac{1}{2}$ grains were given. At this time all lesions were completely healed, but two more injections were given as a precautionary measure.

The 3 cases reported by Bonne were from South America. Two of them were well advanced. The results obtained were very satisfactory,

¹ British Medical Journal, September 16, 1916.

² Journal of Tropical Medicine, May 15, 1917.

particularly with the advanced patients, for whom the author states there was no other hope left than to remain in the hospital as long as they lived. Both were actually cured in the course of a few months. De Souza Araujo, in discussing the x-rays, states that they are efficacious in very early cases, that is, those which come under observation shortly after the appearance of the initial lesion.

Still another case in which antimony effected a cure has been reported by Roffo and Farini.¹ It was a case of the papillomatous form of the disease, of seven years' duration, in which the lesions extended from the inguinal region posteriorly to the anal region. In this case local applications of tartar emetic were employed as well as intravenous injections.

Non-venereal Ulceration of the Genitalia. An interesting paper on the non-venereal ulcerations of the genital organs has been contributed by Aronstam,² of Detroit, who describes six kinds; namely, the herpetic ulcer, the gonococcic erosion, erosion of the sebaceous follicles, the traumatic abrasion, the diabetic ulcer, and the tuberculous ulcer. Herpetic ulcers and erosions of the sebaceous follicles are not at all uncommon and should not be difficult to diagnosticate. The former consist of vesicles, which have a tendency to come out in groups and which rupture and dry up, only to be followed by another out-crop in contiguous parts, so that old and fresh lesions are frequently associated. If sebaceous follicles become infected and obstructed, small abscesses are formed which eventually break, leaving crater-like excavations which form ulcers. If the margins are cauterized they are apt to become indurated, and thus may be mistaken for the primary lesions of syphilis.

The mucous surface of the prepuce and glans penis may become eroded during the course of gonorrhea, so that small raw surfaces may be found on either of these parts. Continued exposure to the infecting discharge from the urethra will sometimes convert them into true ulcers, which may be mistaken for chancroids. Smears from these lesions will, however, usually show the gonococcus. In the prevention of these erosions, much can be accomplished by cleanliness; in fact, the lesions are usually found in subjects who have an elongated and narrow prepuce which serves to retain the discharge. As to treatment, the same methods of cleanliness employed for prophylaxis should be used, supplemented by applications to the little ulcers or erosions, such as mild antiseptic solutions or drying powders like bismuth subgallate or aristol. I have found the latter particularly efficacious in drying up these erosions. The traumatic abrasion is not very important, being caused by injury or excessive moisture, and yields readily to applications of any mild dusting powder. Of course, it is possible that any break on the skin or mucous membrane of the genitalia may be the starting-point of a syphilitic lesion, and in case an apparently simple erosion should not heal after removal of the source of irritation and after the application of simple remedies, one may well be suspicious that it is specific in nature.

According to Aronstam, the genital organs are frequently affected

¹ Revista de la Sociedad médica argentina, May, 1917.

² Medical Review of Reviews, April, 1917.

with diabetic ulcers, which, as a rule, are quite extensive. They may assume a serpiginous and phagogenic appearance, but, unlike the chancreoid, they are not undermined. He states that diabetic ulcer is a clean ulcer, the base and margins being raw and non-pultaceous, and that it is, as a rule, single. Diagnosis can be established only by exclusion. Of course, the finding of sugar in the urine will give a clue to the nature of the ulcer. The author considers the treatment of diabetic ulcer very unsatisfactory, local measures not seeming to benefit it. He advises the application of a 2 per cent. solution of methylene blue, and also states that the high-frequency spark may prove beneficial. The multi-glandular extracts have also seemed to do good in some cases, but in view of our lack of exact knowledge about the internal secretions, he considers that in this affection, as well as in many diseases, the only way to determine their efficacy is to try them in an experimental way.

The tuberculous ulcer is very rare, occurring usually on the glans and on the dorsal surface of the penis. According to the author, one of its principal characteristics is its tendency to phagedena. The ulcer is deep, its margins indurated, and the secretion may be free from micro-organisms even upon repeated examinations. As with tuberculous ulcers on other parts of the body, the presence of the tubercle bacilli is hard to determine. They may appear and disappear with equal suddenness. The so-called sterile pus, however, should always make one suspicious that the lesion may be tuberculous. These ulcers are usually met with in young subjects, although Aronstam states that he has seen a case in a man well advanced in middle age. Guinea-pig inoculation is considered an important method of diagnosis, and the history of the case, together with serological tests, may also afford some information. Treatment of these ulcers is unsatisfactory. Among the measures which have been tried are the x-ray, hypodermic injection of tuberculin, hydrogen dioxide, bichloride of mercury and various other chemicals.

Tuberculosis following Ritual Circumcision. A case in which an infant developed tuberculosis after ritual circumcision has been reported by Mark S. Reuben,¹ of New York, who made it the basis for an investigation of this subject, as the result of which he was able to collect 41 other cases from the literature. A study of these cases elicits the following clinical data: The first symptom is infiltration and ulceration of the wound, which in the majority of cases fails to heal. The disease begins from one to two weeks after the ritual operation, first manifesting itself as small indurated nodules which slowly undergo ulceration. The latter usually begins at the frenum. From two to three weeks after the operation enlargement of the inguinal lymph nodes begins and gradually increases until softening, and not uncommonly suppuration caused by secondary infection with pyogenic organisms, takes place, so that, as a rule, the nodes break down and the superficial tissues become involved. Systemic infection hardly ever occurs before the fourth month. Such manifestations of the disease in other parts

¹ Archives of Pediatrics, March, 1917.

of the body as spondylitis dorsalis, cervical adenitis, tuberculosis of the radius and of the hip, mastoiditis, psoas abscess and involvement of the knee-joint were recorded. It is noteworthy that every case in the series showed tuberculous involvement in other regions of the body. It is stated also that in cases in which recovery takes place, tuberculous disease of the lymph nodes or bones has invariably occurred. In these cases the ulcerations on the penis and suppuration of the inguinal lymph nodes do not heal for months or years after the appearance of the infection. Of the 42 cases reported, there were 11 in which recovery took place, 16 in which there was a fatal termination, and 15 in which a final outcome could not be ascertained. Death usually occurred when the patients were about one year old, the earliest one reported being at the age of three and one-half months and the oldest at three years. Prognosis is most favorable in those cases in which the inguinal lymph nodes undergo early suppuration and which are subjected to operation by thorough curetting or removal. The primary lesion should, of course, be excised.

Reuben's case was that of a child, aged nine weeks, who had been circumcised on the eighth day by a mohel, who aspirated the wound by means of a glass tube. Within a week the wound had healed, but five weeks after circumcision a swelling in the right groin was noticed by the mother who brought the child to the clinic for treatment. Upon examination, the inguinal glands in the right groin were found enlarged. There was also a swelling of the left inguinal nodes, but it was not so marked as on the right side. A close examination of the infant's penis revealed four separate and distinct small nodules about $\frac{1}{8}$ inch in diameter, situated on the anterior surface of the circumcision scar. The largest of the four was excised and upon microscopic examination it was found to be infiltrated with numerous tubercles and diffuse tuberculous inflammatory tissue. The von Pirquet reaction was positive. Two weeks later the infant had gained about one pound. Excision of the remaining tuberculous tissue of the penis together with the inguinal lymph nodes on both sides was recommended. It is not stated, however, whether the parents accepted operation. Examination of the mohel showed that he was suffering from advanced tuberculosis of the lungs, his sputum being filled with tubercle bacilli.

Stricture of Urethra. Stricture from extra-urethral causes is discussed by F. W. Smith,¹ who classifies the principal causes as follows: Spasms of the muscles in and about the urethra; extravasations of blood or urine from injury or other causes; purulent collections and inflammations; neoplastic formations; fractures of the pelvic bones; and growths within the capsule of the prostate gland. Spasms may be due to irritation in the deep urethra; reflex irritations from remote pathological lesions; organic disease of the central nervous system, and emotional excitement. With the exception of that caused by organic disease of the nervous system, the spasm is, as a rule, transitory and intermittent. Peri-urethral inflammation, either in the form of follicular abscesses,

¹ American Journal of Surgery, December, 1916.

gangrenous inflammation or inflammation caused by deep ulceration of chancre or chancroids may give rise to sclerosis, which lessens with the caliber of the canal. Naturally, strictures from such causes are usually in the anterior urethra. Malignant growths may invade the urethra and occlude its lumen. The author states that sarcoma usually affects the corpora cavernosa.

C. L. Begg,¹ discussing urethral strictures attributes only 10 per cent. of all cases to causes other than urethritis. In the remaining 90 per cent. he believes the structure of the urethra determines the site of the stricture; thus the normal dilatations at the bulb and fossa navicularis, and the follicles, mucous glands and masses of lymphoid tissue which are found there, provide recesses which long harbor the gonococci, with the result that localized patches of inflammation persist in these localities long after the other parts of the urethra have become healthy. Individual idiosyncrasy, as well as the virulence of the infecting organisms, is believed to exert an influence upon stricture formation. Violent inflammation associated with chordee will produce a traumatic erosion, which later becomes infiltrated with round cells, so forming the basis for a future constriction. The author believes that the infrequency of bad strictures at the present time is due to more intelligent treatment of gonorrhea and remarks that the strong chemical injections formerly so much used may have been responsible for loss of mucous membrane with subsequent infiltration and contraction.

For diagnosis, he recommends the flexible bougie à boule, and very judiciously calls attention to the three normal constrictions which are present in the male urethra and which must not be mistaken for pathological narrowings. These are at the internal meatus, the anterior layer of the triangular ligament and the posterior layer of the triangular ligament. The second is the most important, as it connects the widened bulb with the beginning of the narrowed membranous urethra, so that resistance may be encountered when the tip of the instrument passes from the former to the latter. There is less likelihood of error being made if a flexible bougie à boule, as recommended by Dr. Begg, is used instead of the ordinary acorn-tipped metal instrument. My teaching has always been that the latter should not be used by the novice. Likewise, excellent judgment is displayed in the author's discussion of the operative treatment of stricture, inasmuch as he insists that operation should not be done in the average case until dilatation has proved impossible. Of course, he recognizes the necessity of urethrotomy in the presence of urinary sepsis. As to dilatation, flexible instruments are advised in all strictures below 16 F. except in those cases in which a filiform can be easily followed by a tunnelled sound. The author uses sounds until the stricture has been dilated to the size of the meatus and then substitutes the branched dilator. When the filiform cannot be passed, he has found that an injection of methylene-blue solution has been very helpful in locating the orifice of the stricture after the urethra beyond has been laid open through the perineum. Internal

¹ American Journal of Surgery, December, 1916.

urethrotomy is advised in all strictures anterior to the bulb, and the author believes that those situated within an inch of the meatus can be operated upon through a urethral speculum. For strictures between the bulb and the first inch of the urethra, the urethrotome is used. For deep strictures, external urethrotomy is advised.

With reference to the operation of EXTERNAL URETHROTOMY, it may be considered applicable to both those patients whose stricture is permeable and to those in whom it is impermeable. In the former class, a history of repeated attacks of retention, with infection of the bladder and a tendency of the stricture to resist dilatation, may be considered the indications for operation. With the exception of traumatic strictures there are few that will not yield to proper dilatation. Naturally, the social condition and means of the patient will likewise influence one somewhat in making the decision. Patients of a type who will pay little attention to themselves after immediate relief from an attack of retention probably will be benefited more by the cutting operation than by being allowed to go on with promises that they will submit to prolonged treatment. Frequently the stricture will yield somewhat to a few days of continuous dilatation secured by fastening an instrument into the urethra. In this manner it is possible to proceed over a filiform to a large whalebone guide or a silk-web catheter much larger than the instrument which could originally be passed through the constriction. Rest in bed during this preliminary treatment, the administration of larger quantities of water and full doses of urinary antiseptics will further prepare the patient for operation. It has been my custom, when ready to operate, not to remove the instrument tied into the urethra until the patient has been anesthetized. Then it is taken out, the urethra thoroughly flushed with hot normal salt or boric acid solution, a syringeful of warm sterile oil injected and a Syme's staff passed. This instrument will usually go through without difficulty. Once it is passed, it is steadied by an assistant and the urethra opened upon it through a perineal incision. An external urethrotomy thus performed upon a guide is a very simple operation, and if sufficient care and time be taken in the preliminary treatment it can be done in this manner even in cases which at first would admit only the passage of a filiform and that only after considerable difficulty. In cases in which it is impossible to get a staff through, an instrument like a filiform may be passed down to the stricture and then exposed by a perineal incision, after which an attempt may be made to pass a probe through the stricture from the external perineal wound.

In a recent paper, J. F. McCarthy¹ describes the technic which he employs in such cases. With the patient in the lithotomy position, the buttocks just at the edge of the table, a Hayden perineal staff is passed over a filiform well down to the beginning of the stricture. This is held in place either by an assistant or is clamped at its distal end. Then the operator steadies the perineum with his left hand and makes

¹ Surgery, Gynecology and Obstetrics, May, 1917.

a median incision $\frac{3}{4}$ to $1\frac{1}{4}$ inches in length between the bulb and the anus, dividing the skin and superficial fascia, after which the point of the knife is plunged down to the staff, which can be felt through the tissues. The deep incision is enlarged by a slight upward movement and then a straight scissors is introduced and the urethral incision still further enlarged. The staff is then withdrawn enough so that the filiform can be grasped, and the Arnot probe director is passed along the filiform, first downward and forward, later upward until it reaches the bladder. If the probe director cannot be passed owing to the small caliber of the urethra, the constricting portion of the latter is incised in the median line until the filiform lies fairly free in its lumen. Once the director has been passed into the bladder the filiform is removed. Then with the groove of the director facing upward, a Gouley probe-pointed bistoury is passed under it until it is slightly beyond the stricture, the latter then being severed as the knife is withdrawn, the movement of withdrawal being upward and outward. Then the director is rotated so that the groove faces the rectum and the stricture is again incised, but this time on the floor of the urethra. A long slender gorget is now easily passed, and, finally, a short broad one is passed over the retained one, which is slowly removed. The next step consists in the introduction of the finger to detect uncut bands and to dilate the internal sphincter. Following this a No. 32, or even No. 34, French sound is introduced.

Urethrectal Fistula. This troublesome and refractory condition is discussed by Hugh H. Young and Harvey B. Stone,¹ of the Brady Urological Institute, who report 11 cases operated upon by a method which Young first practised about four years ago. Although dealing principally with the technic of the operation, their contribution does not ignore the etiology, pathology, and symptoms of the condition. Trauma, inflammation, and ulceration associated with malignant growths are the three general causes, the first being the most frequent. In all of the authors' cases it was the sole etiological factor and was caused by traumatism inflicted during surgical operations. These procedures comprised one perineal lithotomy, four incisions for drainage of prostatic abscesses, and six bungling attempts to perform perineal prostatectomy. In 9 of their 11 cases the natural opening in the urethra was in the membranous portion, and the rectal orifice was in the anterior wall. In the remaining cases the fistula opened from the prostatic urethra and passed through the prostate gland. In 2 of the cases there was an associated perineal fistula and in 1 of these there were also two large perineal abscess cavities. In 2 other cases the sphincter of the bladder had been injured, while in several cases damage had been inflicted upon the anal sphincter, causing loss of rectal control. Without exception, the perineum was indurated and scarred. The symptoms were such as might reasonably be expected from the unnatural communication between the lower intestinal and urinary tracts, and consisted of the escape of urine into the rectum and the passage of

¹ Journal of Urology, June, 1917.

gas or even fecal matter through the penis. Those patients whose bladder had been injured suffered from more or less dribbling of urine into the lower bowel.

The operation which has given such good results in the authors' hands is one of considerable magnitude. They describe it practically as follows: After the bladder has been opened through a suprapubic incision, the patient is placed in the exaggerated lithotomy position and a racket incision, beginning in the midline of the perineum, about 3 cm. in front of the anal margin, is carried backward until it meets this margin and is then carried around the anus at the junction of the



FIG. 1.—The racket-shaped incision beginning at the midpoint of the perineum and extending posteriorly, encircling the anus at the mucocutaneous juncture. (Young and Stone.)

skin and mucous membrane. Through the circular portion of this incision the mucosa of the anal canal, and, if need be, the lower part of the rectum are dissected free all around until a cylindrical cuff is separated from its attachments at a point well above the rectal opening of the fistula. This procedure, of course, necessitates a transverse division of the fistulous tract. It is necessary to carry the dissection of the lower bowel backward until enough mucous membrane is separated to enable the operator to pull the segment bearing the fistulous orifice well down beyond the anus. This dissection is best done at the posterior segment of the circular portion of the incision, as the normal planes of cleavage can be found better in this region than if the separa-

tion be attempted around the anterior part of the rectum. The next step consists in dividing the structures of the perineal body through the straight portion of the incision in the midline so as to expose the urethral opening of the fistula. The scar tissue in the perineum is dissected away laterally until the ends of the sphincter ani muscle and the levator ani on either side are exposed. Division of the sphincter ani will give a better exposure of the urethral opening. It must be

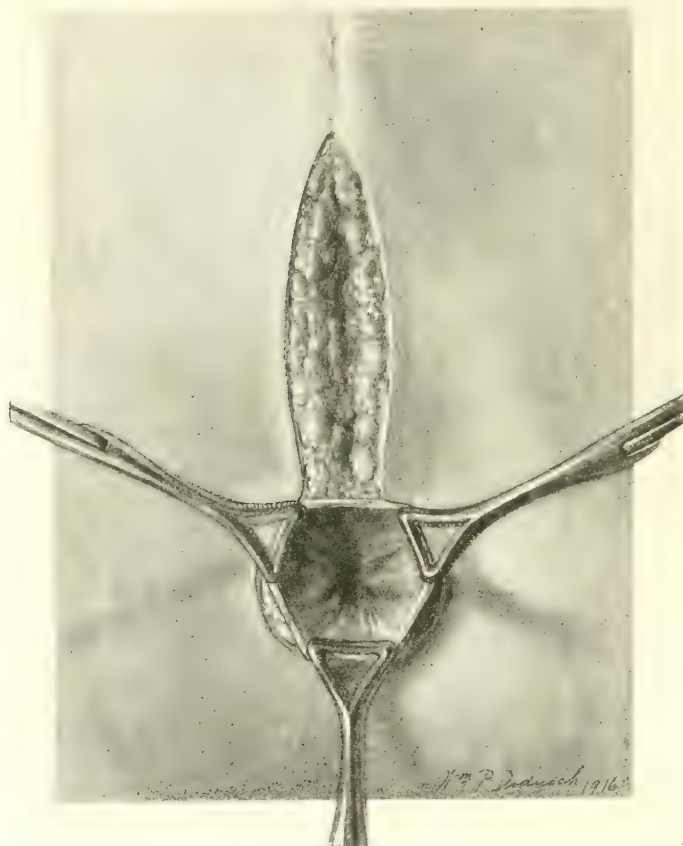


FIG. 2.—The first step in the freeing of the rectal mucosa from the underlying structures. (Young and Stone.)

carefully sutured afterward. When the opening in the urethra has been thoroughly exposed, its edges are freshened and then sewn together with catgut sutures over a sound previously passed through the urethra. These sutures do not penetrate the surface of the urethral mucosa. The muscular layers are then brought into apposition by carefully introduced interrupted catgut sutures, each set of muscles being sutured separately so as to give a good restoration of the perineal body. The

sphincter ani, which is restored last, is closed with a mattress suture of catgut, after which the edges of the straight skin incision are brought into apposition with interrupted sutures. The last step of the operation consists in cutting off the protruding cuff of the rectal mucous membrane in which the fistulous orifice is contained and then attaching the lower end of the rectal tube to the skin at the margin of the

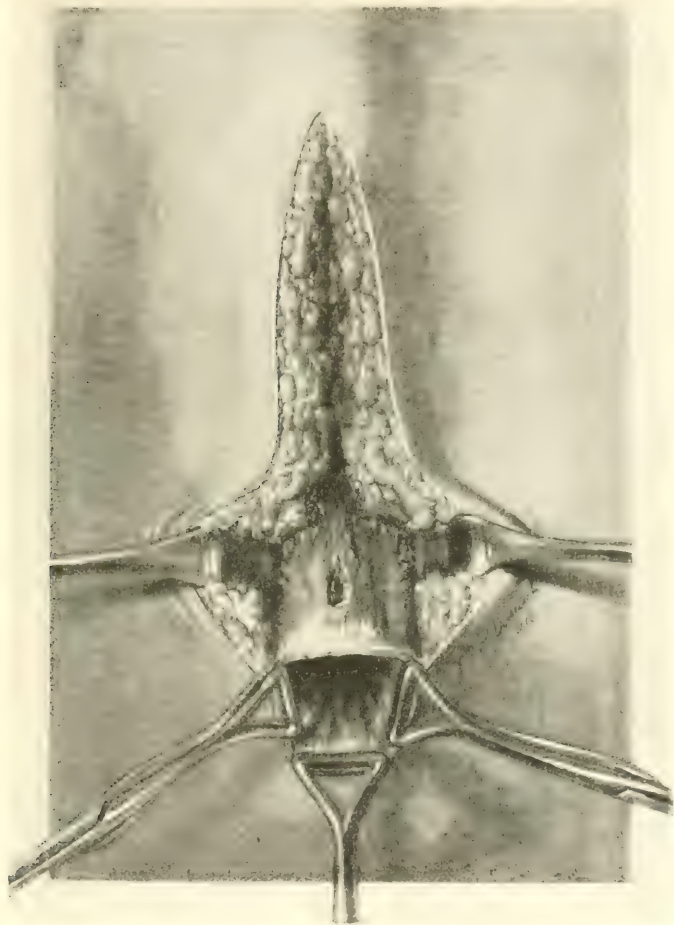


FIG. 3.—The mucosa has been freed to a point well above the fistulous opening and the sphincter ani muscle has been divided. (Young and Stone.)

anus. This closure is made with a series of interrupted silk sutures, which are placed after four submucous, subcutaneous catgut sutures have been introduced at quadrant points for the purpose of anchoring the bladder in place. I judge that these sutures are similar to those used after excision of the lower bowel for malignant growth and that they penetrate the previously reunited group of muscles. This point, how-

ever, is not made quite clear in the author's original description of the operation.

The 11 cases are reported in detail and almost without exception presented many difficulties. Some of them were of long duration, so that the fistulous tract had become thoroughly organized with dense scar tissue. All of the patients had been subjected to one or more previous operations, which served only to increase the amount of cica-

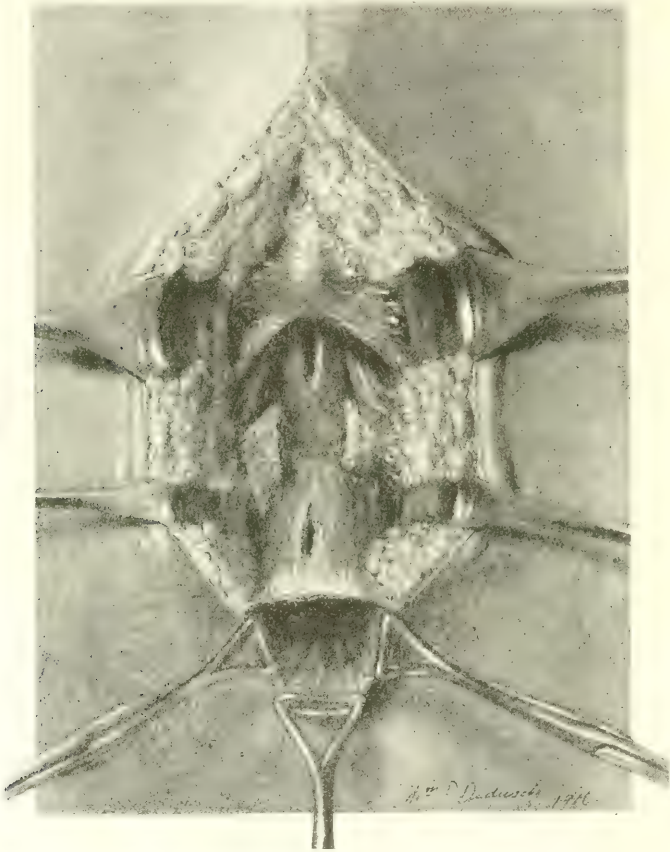


FIG. 4.—The dissection has been carried down through the perineal body and the urethral orifice of the fistula exposed. (Young and Stone.)

tricial tissue in the perineum. In all of the cases but one, to quote the authors' exact words, "a most gratifying degree of success was obtained." The case in which the result was not satisfactory was that of a man who had been operated upon for acute prostatic abscess, which apparently had been incised through the rectum. Although his acute symptoms were relieved, a recto-urethral fistula developed. Five months thereafter an internal urethrotomy was performed, and the urethra

dilated to 34 F. Later on, the fistulous tract was curetted. Both of these procedures were futile.

Upon examination, the anal sphincter was found somewhat relaxed, although there was no scarring of the perineum. Just above the internal sphincter a band of scar tissue was detected extending laterally over the prostate. To the right of the midline an opening in the anterior

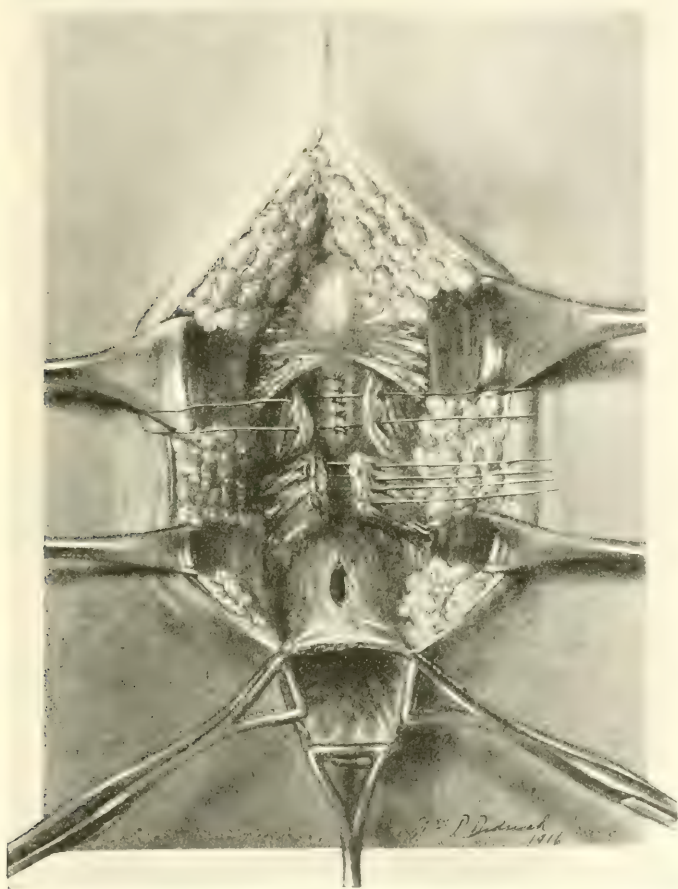


FIG. 5. —After freshening its edges, the fistulous opening in the urethra is closed and the perineal musculature is brought together with interrupted sutures. The cut edges of the sphincter ani are approximated. (Young and Stone.)

wall of the rectum was found. A fine probe passed through it caused pain in the perineum and penis. At operation, it was found that the fistula had passed through the apex of the prostate. The operation was performed in the usual manner, except that the urethral orifice was not sutured, healthy tissue being sewn over it. The patient remained in the hospital 35 days. The fistula did not completely close, as small

amounts of urine, varying from a few drops to a dram, came through the rectum when the patient voided.

Epispadias. An operation for the relief of this troublesome condition is described by J. D. Barney,¹ of Boston. The first step consists in lengthening the urethral gutter by making a longitudinal incision from

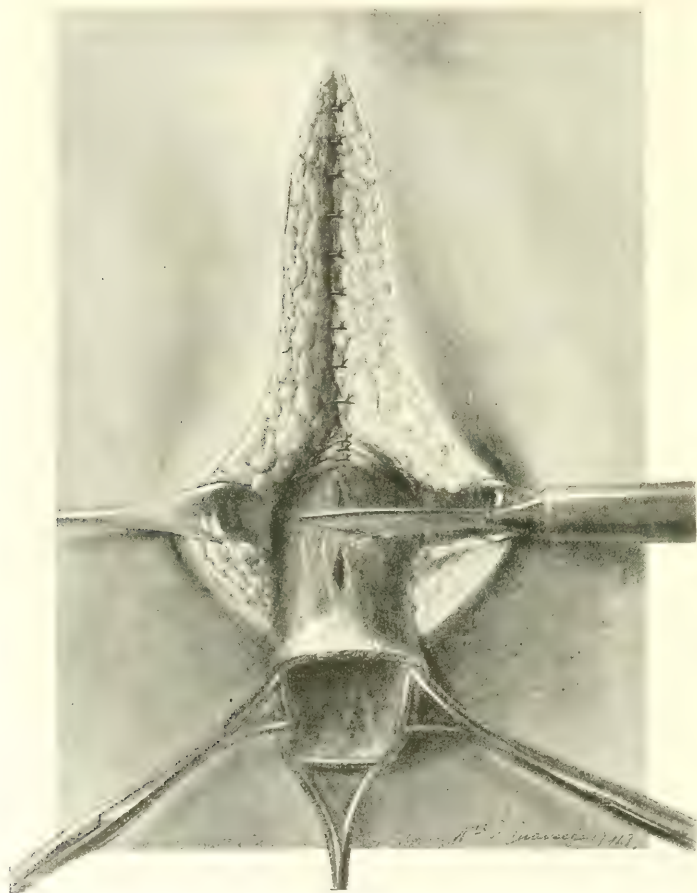


FIG. 6.—The final stage of the operation consisting of the amputation of the cuff of mucosa containing the fistulous opening after which the lower end of the rectal tube is united to the anal skin margin. (Young and Stone.)

its distal extremity out to the end of the glans and then packing it with gauze or rubber tissue in order to prevent its edges from coming together. The packing is kept in until the raw edges have become completely covered by mucosa. The next step consists in making a transverse

¹ Surgery, Gynecology and Obstetrics, November, 1916, xxiii, No. 5.

buttonhole incision through the prepuce just below the frenum and extending laterally nearly to its edges. Denudation of the lower edge of the prepuce is practised at this time and a narrow strip is also removed from the fold of pubic skin which covers the urethra at the attachment of the penis to the symphysis pubis. In the third stage of the operation the glans is drawn through the buttonhole incision of the prepuce in such a manner that the denuded lower end of the latter is brought well upon the body of the penis. This maneuver results in the glans becoming completely surrounded by the edges of the buttonhole incision. Nothing remains to be done now except to suture the cut edges, and the manner of doing this will be readily understood by the accompanying



FIG. 7.—The final approximation of the skin. (Young and Stone.)

illustrations. Thus *A* (Fig. 9) is approximated to *D* (Fig. 9), the inner layers, represented by the straight line, being drawn together with No. 00 chromic catgut, while the outer layers, represented by serrated lines, are united in a similar manner with fine silk or linen thread. Because of the unusual length of the prepuce in the subjects of epispadias, this manner of suture can be carried out without causing any tension. Finally, the edges of the buttonhole incision (Fig. 9, *C*) are sutured to each other, that is, the straight line to the serrated line. Silk or linen can be used for this line of union. When complete, the appearance of the parts is as shown in Fig. 10, *AD* and *C*. The new portion of the urethra and the meatus is seen at *B*. The author states that he has not been obliged to cross-cut

the suspensory ligament and suture it longitudinally to restore the penis to its normal position, as his own operation has sufficed to bring about this result. He advises that the procedure be carried out in two

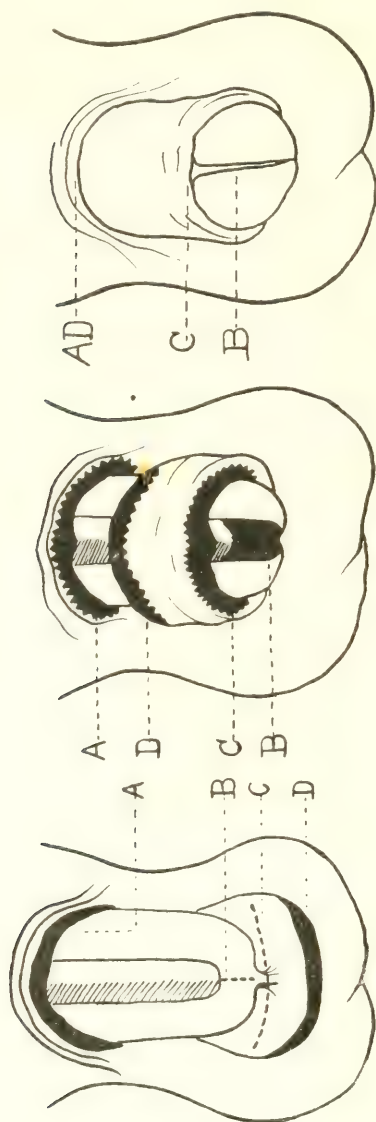


FIG. 10

FIG. 9

FIG. 8

FIG. 8.—Diagram of penis. *A*, refreshed edge of pubic skin fold; *B*, line of incision through glans to prolong urethral gutter to its end; *C*, buttonhole incision through prepuce; *D*, refreshed edge of prepuce for suture to *A*. (Barney.)

FIG. 9.—Diagram of plastic operation. *A*, as in Fig. 8, ready to be sutured to *D*, Fig. 8. The inner or mucous layers (straight edges) are approximated one to the other, after which the outer layers (serrated edges) are united. The outer (serrated edge) layer of the buttonhole incision (*C*, Fig. 8) is then sutured to the inner or mucous layer (straight edge). *B* is the newly formed portion of the urethra. (Barney.)

FIG. 10.—Diagram of penis after operation, showing lines of suture at *A*, *D* and *C*. The entire urethra is now roofed over except the short portion formed at *B*, at which point the urine now makes its escape. (Barney.)

stages, allowing an interval of two or three weeks to pass before doing the more complicated plastic. This will allow the newly formed portion of the urethra to be well covered with mucosa. After the second plastic, the urine is kept away from the wound by the use of an indwelling

catheter, the author preferring it to drainage through the perineum. For children, a general anesthetic is considered essential, but for adults the author has found that local anesthesia will suffice. He states that

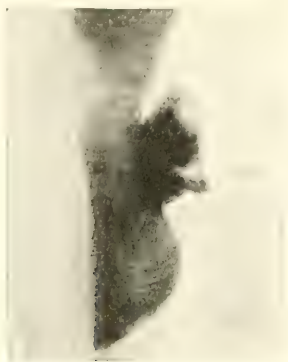


FIG. 11.—Epispadias in profile before operation, showing the almost vertical direction of the penis, its short length, and its voluminous prepuce. (Barney.)



FIG. 12.—Epispadias before operation. Penis drawn down to show extent and position of urethral gutter. The dermatitis of the pubes is also shown. (Barney.)

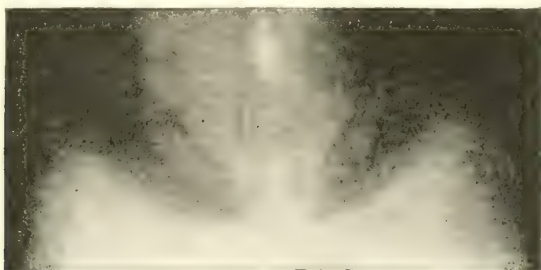


FIG. 13.—Röntgenogram of the symphysis, showing separation of the pubic bones. (Barney.)

plastic flaps will usually fail to unite at one or more points, but that the fistulæ so formed can readily be closed at a subsequent time.



FIG. 14.—Appearance of penis three years after operation. The prepuce can be easily and completely retracted, and the direction of the penis is normal. (Barney.)

MISCELLANEOUS.

Sterility in the Male. In discussing this subject, Lespinasse,¹ of Chicago, lays great stress upon the degree of speed exhibited by the spermatozoa as well as the persistence of their motion. They are best studied under a microscope provided with a warm stage, as changes in temperature will interfere with their vitality. Normal spermatozoa examined an hour to an hour and a half after ejaculation will cross the field under a one-sixth objective in from five to seven seconds. After the second hour, the average speed is from ten to twelve seconds, and after the third hour from fifteen to eighteen seconds; after the fourth hour, twenty seconds, and after the fifth hour twenty-five seconds. Many specimens taken from subjects who it was thought might possibly be responsible for childless marriages, showed that the spermatozoa became motionless within an hour or two after intercourse instead of six hours, as is

¹ Surgery, Gynecology and Obstetrics, May, 1917.

the case in normal subjects. Even in the latter, considerable impairment of their motility occurs after the third hour, as shown by the figures above quoted. Furthermore, Lospinasse has observed that spermatozoa which show a short lease of life are very apt to be abnormal as to configuration.

Another paper on the same subject has been contributed by Louis E. Schmidt,¹ of Chicago, who mentioned the possibility of prolonged cerebral excitement inhibiting spermatogenesis and also thinks the same action may be produced by changes in the internal secretions, although he has not seen any therapeutic results follow the use of glandular extracts in these cases. Lospinasse, however, reports some success in one case from the administration of the anterior lobe of the pituitary gland, the spermatozoa increasing in number and assuming more normal shape. Schmidt considers it possible that there may be something in the blood serum of the female which may impair the vitality of the spermatozoa or even destroy them, and also refers to the effect of abnormal local secretions upon them.

In this connection a paper by Edward Reynolds,² of Boston, who has studied the effect of cervical and vaginal secretions upon the spermatozoa, is of interest. Normal cervical secretion is clear and limpid, alkaline in reaction, and free from bacteria. Its cellular content consists of epithelium, a few leukocytes and occasionally cells which apparently come from the extreme upper part of the genital tract. This secretion is mixed with mucus from the cervical glands. Variations in the number of leukocytes are important, as it has been found that in many sterile women the leukocytosis equals that of the vaginal secretions. When the leukocytes are principally attached to the mucus shreds, it is probable that they indicate a mild degree of inflammation of the cervical glands. The quantity of mucus in the cervical glands is likewise of clinical importance because the spermatozoa become enmeshed in it and are thus rendered motionless. The author believes that such a condition may decrease the number of effective spermatozoa sufficiently to prevent impregnation. The noxious action of the vaginal secretions is considered principally enzymic and of bacterial origin. It is pointed out that either of these conditions may be present without producing any ill health, the only symptom being sterility. Naturally, both of these authors dwell upon the role of gonorrheal infection in inducing sterility in the male by producing obstructive lesions in the seminal ducts and also by giving rise to an admixture of pus in the seminal fluid. It is surprising, however, in some cases at least, how little influence pus exerts upon the fertilizing power of the spermatozoa.

Schmidt's experience with the obstructive type of sterility has been very unsatisfactory, for in only 1 out of 17 cases in which he operated for the relief of obstruction did impregnation of the patient's wife occur. In 3 of the other cases, however, the semen showed spermatozoa in from three to six months after the operation, but they were abnormal and of low vitality.

¹ Surgery, Gynecology and Obstetrics, May, 1917.

² Journal of the American Medical Association, October 21, 1916.

The patency of the vas and ejaculatory duct may be determined by opening the tube and injecting a colored solution. If the occlusion is in the ejaculatory duct or in the pelvic portion of the vas, then the only thing to do, in the author's opinion, is the sac operation, but if it is in the scrotal portion of the vas he states that the resection of the occluded portion with union of the divided ends is worth trying. If obstruction in the epididymis can be determined, then an anastomosis between that organ, above the point of constriction, and the vas may well be undertaken. From the evidence at our disposal at the present time it is judicious not to promise patients too much from any of these operative procedures.

In a comprehensive paper on the subject of male sterility, Abraham L. Wolbarst,¹ of New York, takes exception to the usual method of examining semen and contends that in order to give trustworthy results, the specimen must be examined immediately after ejaculation, both before and after it has been thoroughly mixed with the natural female secretions. He states that he has frequently found living spermatozoa despite the fact that previous examinations of the seminal fluid made from specimens contained in a condom some hours after coitus had shown that the spermatozoa were non-motile. On the other hand, spermatozoa which were actively motile when taken from a condom specimen, and which consequently were considered as capable of fertilization, may become very much impaired or be killed outright if they are brought in contact with abnormal vaginal and cervical secretions.

In conducting examinations it is the author's practice first to examine the vaginal and cervical secretions of the patient's wife, and determine their relative acidity and alkalinity as well as their gross characteristics. Then immediately after coitus a drop of seminal fluid is taken from the vagina and examined under the microscope, particular attention being paid to the number, motility and shape of the spermatozoa. Such an examination is repeated every twenty minutes until three have been made. Thus it is not only possible to determine the degree of vitality of the spermatozoa at the time of emission, but also to find how they react to the female secretions. Naturally, if the spermatozoa are normal in shape and number, are motile and survive in the vaginal and cervical secretions, it is safe to assume that the childless marriage is not due to any fault of the husband. When oligospermia, oligoneospermia, azoospermia or aspermia are present, then a most careful examination of the husband must be made in order to determine the source of the trouble. Prostatitis, vesiculitis, epididymitis and colliculitis are common etiological factors.

The author believes that no examination should be considered complete until the deep urethra has been examined with one of the modern posterior urethroscopes and the condition of the verumontanum and orifices of the ejaculatory ducts has been determined. When the seat of the trouble is found to be in the verumontanum, local treatment through the urethroscope is considered the only efficient method of

¹ New York Medical Journal, May 19 and 26, 1917.

therapy. Obstruction caused by papillomata, cysts or tissue deposits may be relieved by fulguration, and occluded ducts may be opened with fine probes. The author believes that in cases in which azoöspemia is caused by chronic vesiculitis, better results will be obtained by opening the vas and injecting argyrol than by the radical operations of vesiculotomy and vesiculectomy. This is in accord with my opinion, as the former measures have given me excellent results. This method is supplemented by massage, which the author has sometimes practised while the urethroscope has remained *in situ*. He has observed the discharge of pus and tissue debris when this has been done. When the vas deferens is contracted, or even obliterated, an attempt may be made to dilate it by passing a filiform or a piece of very fine piano wire through it. Wolbarst has done Martin's anastomosis operation eighteen times, but in only one case has it proved successful. In that instance an abundance of spermatozoa appeared in the seminal fluid within four months after the operation, and the patient's wife became pregnant about a year thereafter. In 2 other cases a few spermatozoa were liberated after the operation, but impregnation did not take place. In 5 of the cases, either the vas deferens or the ejaculatory ducts were found obstructed at the time of the operation, thus rendering the procedure futile.

Data obtained from the study of 87 cases in which the fault was attributed to the husband are given by the author. The patients had been married from three to eighteen years. Of these 87 cases, 50 per cent. were due to azoöspemia, 35 per cent. to oligonecrospermia, 13.5 per cent. to oligospermia. It is not stated what the condition was in the remaining 1.5 per cent. of the cases. The most common cause of azoöspemia was double epididymitis, which was operative in 72 per cent. of the cases; 58 per cent. of them were caused by gonorrhea and the remaining 14 per cent. by tuberculosis. The most frequent causes of oligospermia were coliculis, prostatitis and vesiculitis. In this group, changes in the verumontanum were considered causative in 58 per cent. of the number. Here again the percentage due to previous gonorrheal infections was high, constituting 41 per cent. of the total number. Coliculis, vesiculitis and prostatitis were also the most common causes of oligonecrospermia. An examination of all the figures submitted by the author shows that in 60 per cent. of the 87 cases the sterility could be traced to the effects of previous gonorrheal infection.

Fat as a Hemostatic in Renal and Prostatic Surgery. Irvin S. Koll,¹ of Chicago, has continued the experiments begun by Kolischer concerning the hemostatic action of fat, particularly with reference to the control of bleeding in the cavities left by enucleation of the prostate. His experiments were performed upon dogs whose kidneys were bruised and cut after they had been decapsulated, the masses of fat being interposed between the edges of the wounds or sutured over the bruised parts. These procedures were carried out both in infected and non-infected kidneys. It was found that the fat acts as an efficient hemo-

¹ Mississippi Valley Medical Journal, February, 1917.

static, probably because it swells up and thus forms a cushion which exerts pressure, and also probably because some ferment is elaborated which increases coagulation of the blood. Histological study of specimens removed some time after operation showed at the site of the wounds a reticular connective tissue which was becoming fibrous. In some instances the kidney had contracted from one-fourth to one-half its normal size, and also showed the formation of a new capsule. Those that had been cut into deeply showed some necrosis. The fat placed beneath flaps of mucous membrane of a dog's bladder rapidly disintegrated and disappeared. These experiments were carried out because the anatomy of the prostate in the dog makes it impossible to simulate the operation of human prostatectomy. The author states that at present sufficient clinical experience has accumulated to warrant the belief that the method is of practical value. In the operation of prostatectomy the space left by the removal of the gland is filled with fat and several interrupted catgut sutures are placed over the edges of the cut mucous membrane to hold it in place, just sufficient opening being left for drainage. The fat will slough off within two or three days. Before it is introduced the cavity is rendered free from oozing either by hot irrigations or by tamponing for a few moments with gauze. The fat used for this purpose is obtained from a dog, under strict aseptic precautions, and is placed in salt solution in an air-tight sterile container. It may also be obtained from the patient at the time of operation. Fat has also been used in kidney operations. For example, after an incision into the cortex for removal of stone, the wound thus made is plugged with a piece of fat, another piece is placed over the incision and the sutures are then passed through this plug and tied over the other piece. Lacerations are repaired by using a large piece of fat and including it in the suture.

Fuchsin in Urology. Veckl¹ speaks highly of the germicidal action of this substance which he has used extensively in infections of the urethra and bladder and which he states has given him better results than any other remedy. As most germs are fuchsinophile the author thought that the dye might prove useful in infections. At first he employed it carefully in mild and chronic conditions, and then gradually extended its use to acute inflammations. It does not produce pain at the time it is used, nor does it give rise to any severe reaction. Under its use gonococci, colon bacilli and other bacteria disappear rapidly, so that in most cases discharges are arrested after a few treatments. In acute urethritis fuchsin injections are given every third day, the strength of the solution being gradually increased. On the intervening days the urethra is irrigated with a mild antiseptic solution. In chronic cases the fuchsin injections are given only once a week or once in ten days. The point is not to repeat the treatment until all traces of the previous injections have disappeared. It is stated that special care must be taken in the preparation of the solutions. Undissolved particles of the product cause disagreeable symptoms in the urethra and especially in

¹ California State Medical Journal, September, 1916.

the bladder. Isorubin, or new fuchsin as it is called, is not only more soluble in water, but also free from arsenic and is considered the best of all preparations for this purpose. Vecki uses three different solutions, 1 per cent., 0.5 per cent., and 0.25 per cent. In the preparation of a 1 per cent. solution 10 grams of fuchsin are placed in a mortar, and thoroughly crushed, then 20 grams of absolute alcohol are added, the mass is carefully stirred for fifteen minutes, and, finally, 980 grams of distilled water are added to complete the solution. The weaker solutions are prepared in the same way, using smaller quantities of the ingredients. Immediately before using these solutions should be filtered. Owing to the staining properties of fuchsin, it is necessary to protect the patient's clothing and he should also be told that his urine will be stained red for a day after the treatment.

Heat Hyperemia in Urology. Maximilian Stern¹ has devised an apparatus by means of which a current of hot water used for inducing hyperemia along the genito-urinary tract is kept at a constant temperature and is passed in and out of the urethra as a steady stream.

The apparatus consists essentially of a container for the water, through which passes an electrically heated spiral, the water in which can be heated to 130° F., 180° F., or to 212° F. The stream is actuated by air-pressure, through compressed air in a separate tank and can be regulated in size down to a mere drop, as is indicated in cysto-urethropic examinations and for postoperative proctocolysis. Special instruments have been devised for use with the apparatus. First the author has devised an irrigating tube for use in the anterior urethra. A second instrument consists in a curved catheter for use in the prostatic urethra. It is provided with two supply openings on the convexity well back from the tip, also a discharge opening on the convexity, near the tip. A third instrument consists of an irrigating dilator provided with discharge orifices at the sites of the fossa navicularis, the pendulous urethra, the membranous urethra, the prostatic urethra and the trigone. Each of these openings can be closed.

Acute infections require lower temperatures for their treatment than subacute or chronic infections. In fact, heat is contra-indicated in acute purulent infections with gonococci. It is impossible to kill the gonococci in the tissues through the agency of heat in these cases. On the other hand, subacute and chronic Neisserian infections respond well to the treatment, the patients improve markedly from the beginning, and after two or three weeks of treatment the secretions are free from gonococci and remain so.

The treatment is also indicated in strictures and infiltrations of the urethra, and also after operations upon the prostate or upon the neck of the bladder.

Alypin Poisoning. In this review a few years ago cases were reported in which poisoning took place from the use of alypin in the urethra. Two other instances have recently been put on record by L. C. Jacobs.² In both of these cases 2 drams of a 2 per cent. solution were injected

¹ Urologic and Cutaneous Review, April, 1917.

² California State Medical Journal, July, 1917.

into the urethra, after which an instrument was passed. In 1 case it had entered the deep urethra, in the other it had only passed the meatus when toxic symptoms began to manifest themselves. In the first case the patient was seized with a clonic spasm, which was followed by a tonic spasm, the face becoming cyanotic and the jaws locked. The respiratory muscles were also affected, but by unlocking the jaws and making traction on the tongue, respiration soon became normal. The patient was conscious, though dazed, and could not remember his name or his place of abode. The second case was much the same, although the patient stopped breathing and it was thought he was dead. Artificial respiration, however, succeeded in restoring him. It took this patient five hours to get over the toxic effect of the drug. From these cases it would seem that great care should be exercised in using alypin. I have not used any since the cases previously reported came to my attention. Novocain seems to be the best local anesthetic to use in the urethra.

The Use of Electrochemical Iodine in Urethral Infections. Geza Greenberg¹ uses with good results the American electrochemically prepared iodine suspension of the same strength as ordinary tincture of iodine. It is well adapted for chronic cases of gonorrhea that have resisted the effects of silver nitrate solution. Often it may be used in alternation with silver nitrate solutions as irrigations or as instillations. It is especially indicated in chronic prostatitis, seminal vesiculitis and chronic deep anterior urethritis that have resisted other treatment. It must not be allowed to remain in contact with the diseased tissue too great a length of time, but should be retained in the urethra one hour only. This result is attained by the patients wearing a cotton plug in the meatus for one hour, during this time the penis being kept suspended by appropriate dressings. The author instils 5 c.c. of the iodine suspension at each séance.

A New Culture Medium for Gonococcus. Thompson² recommends the following medium as an excellent culture for growing the gonococcus: Prepare nutrient agar 2.5 per cent. in the ordinary way with bouillon and Witte's peptone 1 per cent., and render it 0.6 acid. Instead of adding to this 0.5 per cent. of sodium chloride, as is usually done, add all the salts natural to human blood, as in Ringer's solution (NaCl 9 gm., CaCl₂ 0.25 gm., and KCl 0.42 per liter); then add glucose 2 per cent. and put into tubes. A sterile tube of agar is melted in boiling water and after allowing it to cool to about 50° C. 1 c.c. of human blood plasma is added to each tube and is thoroughly mixed with its contents by rolling the tube between the palms. The medium is allowed to solidify in a sloping position. For plating, the contents of three tubes may be added to a Petri dish.

¹ New York Medical Journal, March 10, 1917.

² British Medical Journal, June 30, 1917.

SURGERY OF THE EXTREMITIES. SHOCK. ANESTHESIA, INFECTIONS, FRACTURES AND DISLOCATIONS, AND TUMORS.

By JOSEPH C. BLOODGOOD, M.D.

MILITARY SURGERY.

I HAVE been forced this year to confine my review entirely to the literature on military surgery, because, in the first place, for my own information, I desired to review the literature as completely as possible; in the second, much of my time has not been my own, and I have been unable to go over the literature of other branches as thoroughly as usual, especially on sarcoma of bone and cancer of the extremities.

Books on Military Medicine and Surgery. Edward Martin, M.D.,¹ Chairman of the Editorial Committee of the National Council of Defense, describes the need for text-books to be employed in the intensive training of the now more than ten thousand medical reserve officers. These books will be published by Messrs. Lea & Febiger, of Philadelphia. They are of the pocket-manual size, and the first volume, on *Military Hygiene and Sanitation*, by Major Vedder, has been published since Martin's letter, August 4, 1917. The second volume, by Colonel Goodwin, *Notes on Army Medical Service*, will soon be published. I have reviewed this book from the original manuscript in the following pages. It is to be hoped that this series ultimately will furnish the essential information in military medicine and surgery. This information will be based upon a thorough review of the literature up to date, unpublished reports from the different hospitals in France and England, and in many instances it is planned that the writer of each manual shall visit the front for a few weeks and get first-hand information and observation.

We hope that we will be able to publish manuals covering the subject of transportation, military orthopedics, the soldier's foot, the surgery in the zone of advance, with special reference to the treatment of infected wounds and primary fixation; one on splints actually employed at the firing line and at the base hospitals. These manuals should be in the hands of not only every member of the Medical Reserve Corps, but they will contain information of great value to every civil surgeon and sanitary expert.

The surgery of this war will have a profound influence on peace surgery. The lessons of sanitation and preventive medicine learned will be of inestimable value to physicians in general practice, to physicians in industries, and to public health officials.

¹ Journal of the American Medical Association, 1917, lxi, 388.

In addition to these war manuals, there are a few books that have been published which should be thoroughly studied by every military officer: *Infected Wounds*, by Carrel and Dehelly; *Notes on Military Orthopedics*, by Col. Robert Jones; and *Military Medicine*, by Hurst. These books are published by Paul B. Hoeber, of New York. I have carefully reviewed the first two in this contribution.

Military Medical Schools. The Surgeon-General's Office of the U. S. Army has been divided into a number of departments. These are selecting medical men for special work in their specialties, and are organizing in this country postgraduate schools for intensive training of younger men in the different specialties which bear definite relations to the demands of surgery and medicine in this war. After training in this country, a number will be sent abroad for further training in the hospitals in England and France. Never before in the history of medicine has such an opportunity been offered to young medical men with good education and some hospital training, to get, in a short time, a special course in one of the great departments of medicine and surgery, and then an experience at the front which will qualify them on their return to this country to take an advanced position in some specialty of medicine or surgery, which they probably would have been unable to obtain had they remained in their environments at home. A group of young men has already been sent to England to study under Colonel Jones. A large number of young Medical Reserve Corps officers has been placed in the various dressing stations and hospitals behind the firing line in France. X-ray schools have already been established in a number of large clinics in this country.

Professor William Welch, of Johns Hopkins University, on his return from a visit to England and France, emphasized that this was the greatest opportunity ever offered to medical men for intensive study and a huge experience which, if embraced in the proper spirit, would not only be of lasting benefit to themselves, but to the science and art of medicine. The great Swiss surgeon, Kocher, who has recently died, made the same statement.

The majority of men in the medical profession today who are holding back do not seem to realize this great opportunity.

At the present time there are not enough well-trained orthopedic surgeons in some parts of the country for the needs of the home communities, and here is an opportunity to remedy this. There is also a great field for plastic oral surgery, and the majority of our surgeons and dentists have not had the training, nor the experience, to meet the demands for the repair of the huge defects from wounds in the region of the jaws and face.

I am confident that the majority of industrial surgeons have, up to the present time, failed to grasp the economic importance, as well as the humanitarian aspect, of reconstruction and reëducation among men crippled in the industries. Without much doubt, the experience of this war will also remedy this industrial shortcoming.

The Surgeon-General of the Army is doing his part with the help of the army medical officers and many Medical Reserve Corps

officers. The Surgeon-General has been furnished the means and the authority, but the number of medical officers which will be required in this great drive for democracy is at present absolutely in the hands of the medical profession of this country. We must furnish the men, or the medical department of the army will fail through no fault of its own. The demand for medical men will ultimately reach 45,000. The responsibility at the present time rests with doctors not yet in the Medical Reserve Corps. Those who, from various circumstances must remain at home, have equally important responsibilities. The medical schools' efficiency must be kept up. The health of the public must be preserved by the strenuous efforts of public health officials. Civic hospitals and the population must not be neglected.

I have recently discussed these problems in the *Southern Medical Journal* (September 1917, x, 746).

Medical Officers' Training Camps. In addition to the study of the new books and to intensive training in the purely medical and surgical problems of the war, it must be remembered that a large number of medical officers must have some knowledge and special training in the purely military side. Camps of instruction are well established at Fort Oglethorpe, Fort Benjamin Harrison and Fort Riley, and several thousand reserve officers have received their training. The camps have their full quotas now, and many more must and will be trained there.

The training of a medical man from civil life for war service presents new and very important problems, many of which are by no means settled. Colonel Munson, of the Surgeon-General's Office, is directing the training in these three camps, and each camp is under the personal supervision of a splendidly equipped Medical Corps Officer. But the Medical Corps Officers also need special training, because this war presents many new problems in every department of military medicine and surgery.

Military Medical Literature. In addition to the books already published and to be published which I have mentioned, every military officer should subscribe to the *Military Surgeon*, published by the Association of Military Surgeons of the United States, from the Army Medical Museum, Washington, D. C. This journal will probably be the chief medium through which the very latest information can be conveyed to medical officers. It is remarkable how the various medical journals of this country have responded to the demands of the war and have given their pages freely to the latest information in regard to the Surgeon-General's Office, the Medical Section of the National Council of Defense, letters from the front, information in regard to the Medical Reserve Corps, original articles on military medicine and surgery, and excellent reviews. But the tremendous labor of intensive reading and training has only begun. The rank and file of the medical profession in this country are not attending this new school of instruction with the interest and concentration that the demands of the war require.

At the last meeting of the American Surgical Association there were but two or three papers on war surgery. The majority of men at that time interested in its problems were chief surgeons in base hospitals in

France. But their colleagues, who were soon to follow them, were still concentrating their attention on problems of peace surgery, having little or no relation to the new requirements. In the last few months this has changed, due, I feel certain, to the development of the new special departments in the Surgeon-General's Office, and the information which the medical and surgical journals of this country were disseminating to their readers.

Shock. Archibald and McLean¹ were very much impressed after their eighteen months' service in France with the large number of cases of shock, and believe that the condition is not so much due to the primary trauma of the wound and the secondary factor of hemorrhage, as to a number of other factors. In the first place, the soldier, before he is injured, may be in a condition of extreme fatigue, and in the winter season he is usually wet and cold. Then comes the transportation which I have noted in another part, with the necessary rough handling and frequent transfers, the unavoidable delays, the exposure to cold in winter, and painful redressing, if the primary dressing is not as it should be; the increased pain, if the primary fixation was faulty.

Apparently, this paper is based on very recent experience which would indicate that, so far as these observers are concerned, transportation has not improved. From some information which has just sifted through to me, I had hopes that transportation had improved immensely in the past six months.

In the clinical picture of shock they found nothing new, but they record the observation that in wounds of the chest and head symptoms of shock were very rare, while shock was pronounced in wounds of the extremities and abdomen.

Now, if this is true, there must be something in the wound that has a definite relation to the shock, because the other factors—fatigue, cold, rough transportation, delay—must be about the same in all the wounds. It could be easily imagined that rough transportation would be more painful in a compound fracture than in a head or chest injury, and delay a very large factor in abdominal wounds. If this statement in regard to head and chest wounds is correct, we must conclude that the character of the wound largely influences the effect of the other external factors.

The authors found, in their examinations, low temperature and low blood-pressure. This is interesting when compared with the observations of Porter in the trenches, who, as a rule, also found low blood-pressure in the wounded. Therefore the wounded soldier, if Porter is correct, starts on his transportation with a low blood-pressure. The observations of Archibald and McLean were made at the casualty clearing station, which is the first place where it seems possible to give the wounded man rest and proper treatment. The authors were of the opinion that they observed extreme degrees of shock when apparently the factor of hemorrhage could be excluded, and they remark here that intravenous salt was only effective when the shock was due to hemorrhage. This does not agree with my clinical experience which has been carefully checked over a large number of years.

¹ *Annals of Surgery*, 1917, lxvi, 280.

From this recent experience they also agree with the older view that operation during shock aggravates the condition. I have referred to this again and again in my reviews in *PROGRESSIVE MEDICINE*, with the statement that if the condition of the wound, in the judgment of the surgeon, was aggravating shock, an operation which would relieve this factor was indicated.

I think it is important to emphasize the fact that, in some cases of grave shock, operation is indicated at once, because it will relieve the patient of a definite burden. However, when there is nothing in the wound which will aggravate the condition of shock, it is just as imperative to delay.

In their experience with treatment, the authors seemed to get better results with intravenous salt than with subcutaneous. But the effect was transitory, as it only held the blood-pressure up for a few hours. My recent experience during the past two years has convinced me that we must not depend upon the blood-pressure only in estimating whether a therapeutic measure is beneficial for shock or not. These surgeons also tried the colloid solution of gelatin and saline, with questionable results. In 3 cases of blood transfusion by the citrate method the effects were disappointing. Pituitrin seemed to improve the pulse and blood-pressure; its effect was transitory, and it seemed to have no lasting influence.

The authors did not use adrenalin, feeling that it was contra-indicated. This has been my conclusion. External heat and low position of the head, intravenous salt, and bandaging of the extremities apparently gave them the best results.

We must all of us recollect that shock, like some poisons, may be received in a fatal dose for which, at the present time, we have no antidote or specific agent. Nevertheless, every individual in a condition of shock should be given the benefit of the doubt and treatment followed out in all its details and continuously.

Apparently, we have no method of accurately estimating fatal shock until the patient is dead. From my study of the literature since 1899, and my own experience, I am of the opinion that we have no drug for shock. The majority of the treatment is to a certain extent mechanical—position (head low), external heat, absolute quiet, morphine for pain; fluids, subcutaneous, per rectum, intravenous and, in some cases, blood transfusion.

From the experience of this year I am beginning to feel that there may be a field for the infusion of digitalis in certain cases of shock in individuals with myocardial lesions, but I do not know whether it is applicable to war surgery.

SHOCK IN THE TRENCHES. Here we have a most interesting series of papers by W. T. Porter,¹ of Boston, the first systematic study of shock in the trenches. The investigation began in the first-line trench in July, 1916. Porter made a careful study of the men under all conditions, both wounded and uninjured, in the trenches, batteries, observation towers,

¹ Boston Medical and Surgical Journal, 1916, clxxv, 1854; 1917, clxxvi, 248, 699; clxxvii, 326.

sleeping quarters, during the night and day, during quiet periods, and under the heaviest fire.

He first describes the "abnormal life" in these environments. The food was good and served hot; things were clean; the latrines unusually clean and odorless; the sleeping quarters were dark and often damp. At first, it was difficult for him to believe that there were practically no sick. The amazing efficiency of all the men he attributed to good food, the influence of the officers, the periods of rest.

He soon found that life in the trench was almost as normal as in Boston; although he does not mention it, I should judge he found it much more interesting. Soon one takes life under fire as a matter of course, and Porter found that soldiers under these conditions, even after a long bombardment, showed no change in their blood-pressure. Later, he had an opportunity to observe men under a storm of eight-inch shells. This proved not to be an indifferent matter—it did excite emotion and tended to raise rather than lower the blood-pressure.

There were cases of shock from air-pressure from the explosion of huge shells—no visible wound, but paralysis and low blood-pressure. This confirmed previous experimental work of Porter. He was unable at this time to get any data on the effect of inhalation of the hot gases liberated by these explosions.

Porter describes why a wounded man has a low blood-pressure. A shell explodes in a first-line trench. A man is wounded. The stretcher-bearers are called. They carry him back a mile through a narrow trench and have difficulty in passing lines of men carrying hot food forward. Then he is carried into a cellar, his wound is bandaged, antitoxin for tetanus given. Now he is placed in a rack in an ambulance and is shaken in a ride over a rough road, pitted with shell fragments. Cold air comes into the ambulance and chills him. After an hour the roughness of the road changes, but there is the same jolting; then there is a sudden stop; again he is lifted from his rack, carried, laid on the floor; orderlies appear with a bag for his clothing; now he is placed on the bed, stripped and washed. The surgeon now appears, observes the shock, orders hot bottles and intravenous salt. Often the patient gets a cold bottle and not too hot salt infusion. He is then carried to a chilly operating room, placed naked on a cold table, chloroformed; the wound is opened widely; vessels are tied; now he returns to a bed and a friendly nurse, late in the game not due to her fault, who surrounds him with hot bottles, gives him a stimulating hypodermic. Then he takes his chances.

Porter remarks that this is a typical case, and explains why so many die from low blood-pressure. Compare this graphic description with what I have quoted from Archibald and McLean in the beginning of this note on shock and, on p. 210, on transportation.

Porter confirms the observation that the wounded have low blood-pressure, and is of the opinion that a large number of these should be saved.

He is also convinced that the explanation for low blood-pressure is the same in both animals and man, and that his observations on animals

in the experimental laboratory can be employed in conjunction with his observations upon low blood-pressure in wounded soldiers. The treatment found effectual in the experimental laboratory upon an animal will be found effectual on the wounded soldier. The three essential parts of this treatment are gravitation, injection of normal saline, and adrenalin.

On coming from the ambulance the injured soldier with low blood-pressure should be placed immediately on a special table (Fig. 15). This table is heated by electricity. The feet of the patient must be 30 cm. higher than the head. The patient must remain on this table until the pressure has reached almost normal. It may take an hour or more.

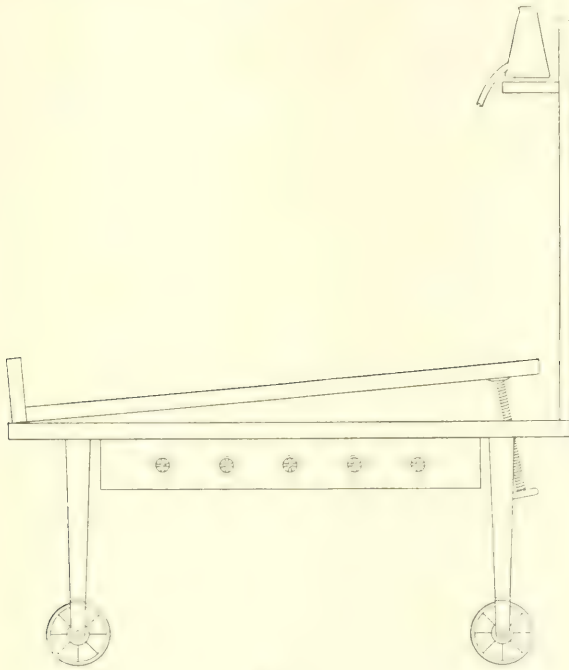


FIG. 15

If the blood-pressure is below 80, give the saline intravenously; stop when the pressure reaches 80; if the pressure falls again, give adrenalin in a vein near the ankle. When there is low blood-pressure with persistent hemorrhage, even slight, transfusion of blood should be done at once.

Granting that theoretically this is correct, can it be done in this way? First, the blood-pressure would have to be taken on all the wounded as they come to the ambulance, at least on all those with clinical evidence of shock. Then there would have to be a number of these electrically heated tables. Is this possible in the casualty clearing station? To take the blood-pressure of many wounded, every hour, would require a large personnel. Porter states that at La Panne,

Depage's hospital, he observed the practical results of these procedures, and Carrel informed him that these methods were employed at Compiègne. If it could be done at these two hospitals, it would seem possible to do it elsewhere. Porter emphasizes the importance of recording the diastolic arterial pressure at least every half-hour, because the systolic pressure is a less reliable guide. The longer a low blood-pressure, the more difficult the recovery. Yet desperate cases have been saved.

In the second article, Porter¹ remarks that the surgeons at La Panne and Compiègne observed shock more frequently and to a greater degree in shell fractures of the femur, and less in shell fractures of the humerus. These facts were significant to Porter, who apparently was of the opinion that fat embolism may be a large factor in the production of shock. All surgeons have observed shock in a greater degree in compound fractures. He refers to the article of W. W. Bissell,² who called attention to the relation between fat embolism and shock. In 1913 I³ reviewed four articles on fat embolism with symptoms of shock. Again, in 1916, I⁴ referred to Buerger's experience with fat emboli in military surgery.

These papers brought out the common occurrence of fat embolism after fracture, but did not emphasize its relation to shock. Porter, from his experience and experimental work, concludes that fat embolism is a cause, though not necessarily the only cause, of shock after fracture of bone.

In his third paper⁵ he is interested especially in respiratory suction as an aid in the treatment of shock. He is of the opinion that life and death depend on a relatively slight change in the arterial pressure. In shock the individual bleeds into his abdominal veins, taking blood from the heart and brain. Gravity keeps blood in the heart and brain, but gravity is a slow process. Injections of saline and adrenalin into the vein help, but these remedies are not always efficient. Porter proposes a thoracic pump to drive blood to the heart and brain. He has experimented with this on animals, and is now on his way to France to try it on the wounded men.

In his fourth paper⁶ he gives us further observations on shock in the trenches. Again he emphasizes the fact that there is no low blood-pressure in the uninjured, even when the bombardment is at its height; and again his new observation indicates that, in the wounded, shock is not immediate, but develops later. He again refers to fat embolism, and is of the opinion from the more recent observations that it is the principal cause of shock. Among 1000 freshly wounded, shock was only, and chiefly, observed in fractures of the femur and multiple wounds of the subcutaneous tissue. Shock was also present in wounds of the abdomen with injury of the vasomotor nerve. Now he had an opportunity to try his thoracic pump to increase the respiration by the

¹ Boston Medical and Surgical Journal, February 15, 1917.

² Journal of the American Medical Association, December 23, 1916, lxvii, 1926.

³ PROGRESSIVE MEDICINE, December, 1913, p. 216.

⁴ Ibid., December, 1916, p. 241.

⁵ Boston Med. and Surg. Jour., May 17, 1917.

⁶ Ibid., September 6, 1917.

administration of carbon dioxide. So far this method has always raised the blood-pressure, even in cases of profound shock.

The head of the wounded man is placed in a wooden box 35 cm. square; the end for the neck is in two pieces. The lower piece is fixed and has a semicircular opening for the back of the neck; the upper piece is movable and has a semicircular opening for the front of the neck. This piece slides down on the neck like a guillotine. Cotton filled the crevices. On each of the two sides of the box there is a hole 2 cm. in diameter; cotton plugged these holes, in order to regulate the amount of carbon dioxide and air. Carbon dioxide enters one of these holes from a cylinder provided with a regulating valve. The carbon dioxide bubbles through a water bottle and the volume of gas administered is estimated by counting the bubbles per minute. Enough gas is introduced to double the respiration. The patient is in an inclined position, head low. Great care should be taken to discontinue the CO₂ respiration gradually. Carbon dioxide breathing may be given with the box just described, or after the method of rebreathing emphasized by Henderson in his work on shock, and practically demonstrated by Gatch, of Johns Hopkins. Porter did not use this method during operation, but is of the opinion that it would be an advantage.

Yandell Henderson, A. L. Prince and H. W. Haggard¹ make their preliminary report on surgical shock. The investigation was made at the request of the Committee on Physiology of the National Research Council. They² had made one previous report on the relation of low blood-pressure to a fatal termination in traumatic shock. These three investigators studied three problems: One, the bearing of excessive and prolonged secretion of epinephrin on the production of shock; second, the relation of acidosis to shock; and third, the oxidative metabolism in shock.

With regard to epinephrin, they conclude that it is not an important factor. This apparently agrees with Mann's³ work.

In relation to acidosis, they again discuss the acapnia theory. In previous experiments, Henderson found that when excessive loss of carbon dioxide was prevented by rebreathing, the carbon dioxide content of the blood was only slightly lowered, and shock was prevented or reduced.

In regard to oxidative metabolism, they found that in shock there was a profound depression of metabolism, the oxygen consumption often falling almost 50 per cent.

They suggest that the gas mask has accustomed the soldiers in the trenches to an apparatus with which rebreathing can be readily arranged, and they hope to test the question there as to whether rebreathing will prevent or decrease shock in wounded men as it does in the experimental animal.

This experimental work seems to confirm the views of Porter.

The literature which has accumulated since my review last year on surgical shock is so immense, that it is impossible, for the lack of space, to review it.

¹ Journal of the American Medical Association, 1917, lxi, 965.

² Ibid., June 23, 1917, p. 1892.

³ Ibid., August 4, 1917, p. 371.

I must refer, however, to the recent article of Walter B. Cannon,¹ who gives a remarkable resumé in his Shattuck lecture on the physiological factors of shock, and concludes as follows:

"The central problem of shock, therefore, is to return the stagnant blood to the circulation, in order to give the heart and nervous system their proper nutriment. The methods thus far employed do not approach this problem by a direct attack, and I suggest, in closing, an intra-abdominal therapy which will drive back into currence the idle blood."

The therapeutic agent with which he has experimented is pituitrin, and he is now at the front at work on this problem. Apparently, he proposes to introduce it into the peritoneal cavity, because a stronger solution may be employed there than in the blood, and it would not be diluted by the blood. He hopes that its effect would be chiefly on the portal area of circulation, and that it will drive the blood out of the abdominal vessels.

P. Santy² seems to be of the opinion that shock is rare in the first stage of the wound, but is observed later, and is largely induced by painful transportation and cold. His treatment resembles Porter's: Operating table, head low; external heat by placing a tent over the table and filling it with heated air; intravenous salt infusion; when the condition improves, operation is done. He expresses the opinion that the advanced posts should be equipped for the treatment of shock and for operations on the more seriously wounded.

There is no provision in the ambulance that I know of for heating, nor for the transportation of the patient in the head-low position. I have just started an investigation to see if this can be accomplished.

Fuillade and Blechmann³ have devised a hot cabinet; the room will hold four patients, and in this small operating room the shocked wounded are immediately placed. They are of the opinion that it is possible to arrange this in the advanced operating posts.

Depage⁴ emphasizes the importance of heat, and prefers Locke's serum for an intravenous infusion:

NaCl	0.9
CaCl ₂	0.02
NaHCO ₃	0.02
Glucose	0.02
Water	100.00 gr.

SHELL-SHOCK AND WAR NEUROSES. The best resumé of this subject will be found in the first chapter of Hurst, on *Medical Diseases of the War*, published by Paul B. Hoeber, of New York. This is an excellent summary of the subject. Hurst states that the condition is often observed in peace, and the only difference in time of war

¹ Boston Medical and Surgical Journal, June 21, 1917, clxxvi, 859.

² Lyon Chirurgical, 1917, xiv, 54; review in Journal of the American Medical Association, 1917, lxxviii, 1877.

³ Paris médicale, 1917, vii, 58; review in Journal of the American Medical Association, 1917, lxix, 759.

⁴ Surgery, Gynecology and Obstetrics, 1917, xxiv, Abstr. 507.

is in the large number of cases. There is every evidence of great exhaustion of the nervous system, with various hysterical and psychical manifestations. There may be temporary blindness, inability to hear and talk, partial or complete paralysis, great mental depression with hallucinations and terrible dreams. The etiological factors are fatigue, hunger, exposure to cold and wet, long periods under bombardment, and the sight of men being killed and mutilated. It is more often seen in young officers upon whom the responsibility of command suddenly falls on account of the loss of their superiors.

These patients usually recover with a change to a quiet environment and rest. They require the personal supervision of trained neurologists who understand the therapeutic methods of suggestion and hypnotism. Porter, in his letters from the trenches, does not mention any cases of this kind.

FIRST AID IN INDUSTRIES. I began this discussion in the December number of *PROGRESSIVE MEDICINE* for 1915 in my report of the American First-aid Conference which met in Washington in August, 1915. This Conference apparently reawakened interest of a national scope in the subject of first aid in industries and the great problems of industrial medicine and surgery.

Through this Conference a Board of Standardization was appointed by the President of the United States. It is now over two years since this Board was organized, and it has made a very careful survey, but its report is not yet published.

The real object, however, of the Conference was not accomplished, in that it hoped to rapidly standardize instruction in first aid, materials for first aid, methods of primary treatment of accidental wounds, and the standardization of splints.

When we entered this war we were, to a large extent, unprepared. In the three years since the breaking out of the European war there was time and opportunity for a thorough investigation of many of these problems, but for some reason it seemed impossible to arouse sufficient national interest and to get team work.

The Government, in its endeavor to remain neutral, apparently was of the opinion that it should not take a prominent part in stimulating and directing such an investigation. We could not convince the majority that it was a peace problem just as much as a war preparation problem.

When this country entered the war the Office of the Surgeon-General of the Army and the Medical Section of the National Council of Defense moved as rapidly as possible in the direction of accumulating all the experience of the medical departments of Great Britain and France, and of standardizing methods and materials.

I hope to be able to discuss this in this contribution, but all seem to agree that precious time was lost.

R. W. Knox,¹ the chief surgeon of a railroad, a man of large experience summarizes *first aid as applied to railroads*.

¹ Southern Medical Journal, July, 1917, p. 581.

It is important to remember that Knox has been a pioneer worker in this field, and was one of the prime movers and organizers in the American First-aid Conference. His experience and investigation dates back many years.

In this paper, delivered in May, 1917, he writes: "It is not worth while for me to argue on the benefits of first aid as it applies either to railroads, industrial institutions, or the people at large, even in time of peace."

The railroads have been pioneers, but they have met many obstacles in the introduction of first-aid principles and the standardization of methods.

In train service and among bodies of men who are constantly being moved from place to place, the medical staff has great difficulty in giving the proper instructions, so that at the present time the majority have insufficient information. There have also been found difficulties in this branch of the railroad service in keeping the first-aid material in good condition and in stock.

It is Knox's opinion that in the beginning the medical departments of the railroads attempted to do too much, to teach the men more than necessary. The first-aid equipment was too elaborate and too expensive. The system was complicated and rarely worked after introduced. At the present time it is more practical. Medicines have been eliminated from the first-aid package. The instructions are very simple. The men are told what not to do and what few things they can do before the arrival of the surgeon. They are especially impressed that the most important thing to do for an injured individual is either to transport him rapidly to the nearest physician or to get the physician as rapidly as possible to the injured man. As Colonel Battle, of the Norfolk and Western Railroad, says, transportation is the business of a railroad, and rapid transportation, except in cases of great accidents, is going on along the rails all the time; the railroad man needs special instruction in the handling of the injured and how to transport them to the train on regular or improvised stretchers; also how to make them comfortable on the train.

I had a recent observation in which the transportation of the injured man was better than his handling after he reached a well-equipped hospital. This patient sustained a compound fracture of both legs near the knee-joints. The wounds were well bandaged with sterile gauze. The patient was properly and gently placed on a stretcher, put in a freight car and transported over one hundred miles. On his arrival it was found that the stretcher was too long for the hospital elevator. In changing the patient from the railroad to the hospital stretcher, in order to take him up on the elevator to the operating room, the injured man was so clumsily handled that he reached the operating room shocked, with recurrent bleeding from the wounds. Fortunately, he recovered with good use of both limbs. But here we had an example that the railroad employee had been better instructed than the hospital employee in the handling of an injured person.

First-aid Package. Knox provides each train with what is called the conductor's accident case. Its contents is as follows:

- 2 Red Cross First-aid Packets.
- 1 half-dozen 2-inch roller bandages.
- 2 collapsible tubes 1.5 per cent. carbolated vaseline.
- 1 cylinder of 1-inch adhesive plaster.
- 1 package of absorbent cotton.
- 1 half-dozen safety pins.
- 1 dozen pledgets sterilized gauze in individual glassine envelopes.

Recently he has added one-half dozen iodine ampoules with swabs.

With each box there are printed directions how to use the contents and how to keep the stock up. The cost of this package is approximately one dollar.

This conductor's accident case is supplied to passenger and freight trains, to station agents at remote points, to section and signal gangs, and to small shops.

In this group of railroad employees there must be individual instruction to at least one member of each small unit, and, if possible, to all members.

In the large railroad shops, where a number of men are employed in one building, the problem is less difficult. In this shop there is built and equipped a small surgical dispensary, and, if possible, this is placed in charge of a trained nurse in conjunction with a doctor, easy of access. This physician makes his visit at least once a day. No case is sent to the hospital until the physician has made the proper examination and applied the primary dressing. The trained nurse is on duty throughout the working hours.

In shops employing small numbers of men, the foreman only receives the instructions and is provided with the necessary material.

In very large shops located near a well-equipped hospital the surgical dispensary is omitted, and physicians from the hospital visit the shop, give the employees the necessary first-aid information, so that the injured individual can receive the first proper treatment and then be taken to the hospital at once.

From my study of the situation, I get the impression that in all large shops there should be, in the same building, one or more surgical dressing rooms not only properly equipped with material, but with the daily attendance of a trained nurse or physician. This should be so, whether there be a hospital near or not.

The Ford Motor Works have such an establishment, notwithstanding the fact that hospitals are near.

The most important thing in first aid is to shorten the time of the primary treatment, if possible to have this primary treatment administered by a physician or trained nurse, and to reduce the transportation to the minimum until the injured individual has been carefully examined by a surgeon.

In some of the shops, Knox places the first-aid material in a wall cabinet, and he considers iodine and swabs the most important feature;

next, carbolated vaseline for burns, small pledgets of sterile gauze for the removal of foreign bodies from the eye.

He is of the opinion that there should be instruction in controlling hemorrhage in the treatment of shock, in what should *not* be done, and most careful instructions of what little should be done.

It is Knox's opinion that the failure of first aid among railroads is not due to the negligence of the employee. He does *not*, however, state on whom the odium should fall, except that he suggests that it may be the medical department.

Space forbids further discussion on first aid in industries and the problems of industrial medicine and surgery. Apparently the accidental wound in industrial fractures in the majority of cases is less severe than in this war, and the infection is less in volume and intensity. In addition to that, it is usually possible for the primary treatment to be applied in a short space of time by well-trained surgeons in a modern hospital. From the reports of these industrial surgeons, the results have been uniformly satisfactory when the medical department of the industrial plant is properly equipped and organized. Nevertheless many of these surgeons have thrown aside former and simpler methods for the Carrel treatment, notably Sherman, of Pittsburgh, and Noland, of Birmingham, who claim better results than by the earlier methods.

We should be able to utilize the now well-organized medical departments of the industries and their larger number of industrial accidents for the testing of first-aid dressing, primary disinfection of the wound and the simpler methods of fixation which would be applicable to the primary dressing in war. But up to the present time it has been impossible to organize such an investigation. However, the test of Carrel's method is going on rapidly in industrial surgery, and up to the present time the evidence seems to confirm the views of Sherman and Noland.

British Army Medical Service. It is our good fortune to have in the Surgeon-General's Office Colonel T. H. Goodwin, of the British Royal Army Medical Corps. His lectures on organization, administration, war surgery and sanitation have been published in the *Military Surgeon* (June, 1917, p. 609; July, 1917, p. 33; and Sept., 1917, p. 278).

These lectures have been slightly rearranged and will be published in book form by Lea & Febiger.

In 1913, four years ago, Major, now Colonel, Goodwin contributed a most interesting book, entitled *Field Service Notes*, for the R. A. M. C. (published by John Bale, Sons & Danielson, London, 1913). The third edition of this pocket *vade mecum* is about to be published.

It is very important for a civilian medical man to have some conception of military organization and administration before he can expect to fulfil his duties properly in his new environment as a military medical officer.

Fig. 16 illustrates the position of medical officers from the firing line to the base.

Behind the battalions are *regimental aid posts*. The medical officers who are stationed here are those belonging to the regiments in front. Assigned to them are a certain number of hospital-corps men and

stretcher-bearers. This regimental aid post is a short distance behind the firing line. It moves with the segment of the army in front of it. In trench warfare this first-aid station is in a dugout. When the fighting is out of the trenches, the regimental aid post is placed in the most protected spot near the fighting troops. The wounded are brought there by the stretcher-bearers, or, if they can walk, are directed by the hospital-corps men.

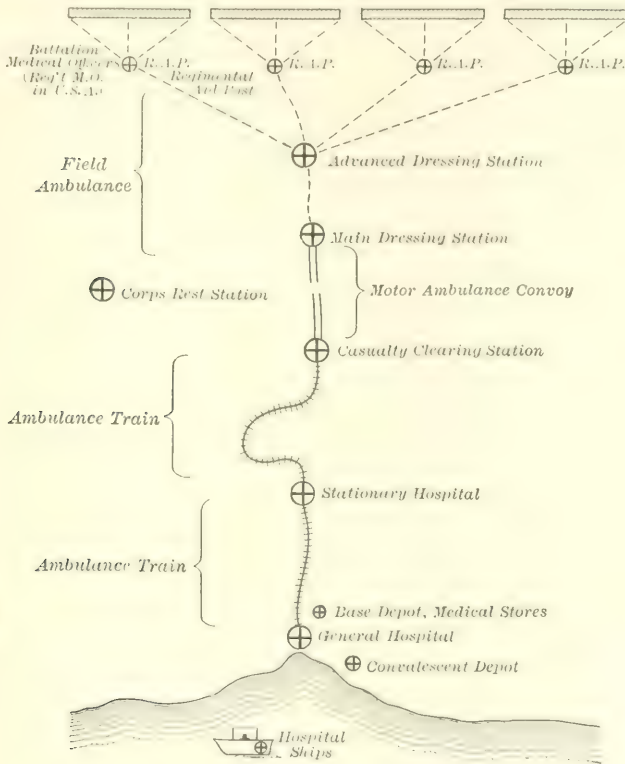


FIG. 16

Theoretically, the wounded man should have a first-aid dressing placed immediately on his wound by himself or a comrade. If his injury was a compound fracture, he should have a temporary splint applied where he fell to hold the extremity rigid during transportation, or the splint should have been applied by a comrade or a hospital-corps man. Practically, in the present war, according to the publications of Col. Goodwin and my personal discussions with him on this point, the wounds receive little or no attention until they arrive at the regimental aid post. This little dressing station is practically for first aid.

I will discuss this point again under first aid, but the impression that I get is, that the chief function of the medical-corps men between the firing line and the regimental aid post is to get the wounded back to this first dressing station as rapidly and comfortably as possible. Apparently

this is the most dangerous zone for the medical-corps men, and in some instances it is only possible to collect, and administer to, the wounded at night. When a soldier is shot while on duty in a trench, it is quite possible that his wound can be attended to at once, but during the height of a real battle, within or without the trench, immediate attention to the wounded is often impossible.

Just what happens between the firing line and the regimental aid posts is very difficult to picture. However, it may be said with great certainty that the ministrations of military surgery cannot, and do not, begin until the wounded soldier reaches the regimental aid post.

DRESSING STATION. FIELD AMBULANCE (Fig. 16). The wounded are transported from the regimental aid post by stretcher, or some other method of hand transportation, to the *dressing station* (advanced dressing station, British Army). Here they are turned over to the surgeons and hospital-corps men of the *ambulance company* (Field Ambulance, British Army). They are now transported by mule or horse ambulance to the *field hospital* (Main Dressing Station, British Army). The advanced dressing station and the field hospital are in charge of a definite medical unit different from that of the regimental aid station.

EVACUATION HOSPITAL. MOTOR AMBULANCE. From the American field hospital (British Main Dressing Station) the slightly wounded walk, or are transported, to a place designated as *Station for the Slightly Wounded* (British Corps Rest Station). These slightly wounded or sick soldiers are expected to return to the front shortly and are therefore not transported back by motor ambulance to the *evacuation hospital* (British Casualty Clearing Station).

Before the motor ambulance was introduced, the transportation in this zone was by the horse or mule ambulance of the American field hospital company (British Field Ambulance). •

In this war the development of military surgery has changed the relationship between the British Casualty Clearing Station and the Stationary or Base Hospital. In fact, they are beginning to call this casualty clearing station the *casualty hospital*, because most of the serious operations are now performed there.

STATIONARY HOSPITAL. BASE HOSPITAL. Although Goodwin calls it in his diagram a *stationary hospital*, it is beginning to be known throughout all military literature as the *base hospital*. Previous to this war practically all medical military preparations provided that all the more important major surgery should be performed at this base hospital, no matter how long a time was consumed in the transportation. But, as stated before, circumstances have forced a change, and the casualty clearing station, now called casualty hospital, is assuming the functions of the base hospital.

The transportation between the casualty and stationary hospital is usually by ambulance train. From this base, or stationary hospital, the soldiers are transported farther back by train, boat, or ship to the various general or convalescent hospitals.

I gather, from a most careful reading of Colonel Goodwin's contributions, from other accessible literature, and from personal conversations

with those who have been at the front, that this scheme, diagrammatically shown in Fig. 16 by Goodwin, represents what was expected to be the usual procedure, but, as a matter of fact, has been changed by conditions which could not have been foreseen. There are, however, definite principles which should guide the medical officer and all of those under him in this so-called surgery of the advance.

There must be a regimental aid post for the first dressing, but it will be impossible to arrange for any major operation in this environment. Practically, here nothing but first aid can be administered. Then all the wounded must be moved back to a more protected place, where these first dressings can be changed, and some minor emergency operations performed. Here, if possible, the wounded should be differentiated and all those on whom operations are imperative should be hurriedly transported to the casualty clearing station.

In some instances it might be possible to transport certain types of wounded directly from the regimental aid post to the casualty clearing station for immediate operation. For example, abdominal wounds.

MEDICAL SERVICE. ZONE OF ADVANCE. *Battalion-regimental Aid Post.* According to Colonel Goodwin, each infantry battalion is furnished with one medical officer, one corporal and four medical-corps men. From the battalion itself there is detailed a sanitary unit consisting of one non-commissioned officer and eight men; also sixteen stretcher-bearers with eight stretchers. The stretcher-bearers are, therefore, not taken from among the medical-corps men. These medical-corps men have had special training in first aid, in the fixation of fractures, and correspond in training to the hospital nurse.

During the quiet period the battalion medical officer looks after the sick, the majority of whom, as a rule, remain on duty; the more serious cases are marked "Hospital" and are turned over to the field ambulance. If you look at the diagram (Fig. 16) you will observe that the territory of the field ambulance in the British Army extends from the battalion regimental aid post to the main dressing station, that is, the transportation for the sick is the same as for the wounded.

This battalion medical officer is furnished with a pocket case of instruments, a certain number of dressings, and drugs. The commissioned officer and the medical-corps men are also furnished with a certain number of dressings, antiseptics, and drugs. This equipment of the battalion medical officer and his medical corps assistants is carried on the back or belt.

During action the battalion medical officer establishes one or more regimental aid posts in the rear of his battalion. The place should be sheltered.

In trench warfare it is a definite dugout in communication with the trenches. The battalion medical officer and his medical-corps men, the sanitary unit and the stretcher-bearers are with the battalion wherever this body may be. It is important to remember, therefore, that medical officers live in the trenches with the soldiers, protect them from sickness there, take care of them when they are ill, dress their wounds there, and transport them to the rear. Colonel Goodwin discusses the question

of what should be the exact position of the medical officer in relation to his battalion when this troop is in the first-line trenches. It is his opinion that the medical officer should be with the commander of the battalion, because there he is more accessible by telephone to all the different trenches and can get immediate information when a soldier is injured. He also states that the regimental aid post in a dugout should be as near as possible to the battalion headquarters and near the main communicating trench. A wounded man, therefore, in being carried to the dugout for first aid, is on his way to the second dressing station (advanced dressing station).

When the battalion moves to attack, it is Colonel Goodwin's opinion that the medical officer should move forward with his commandant, although there is some difference of opinion as to this point.

First Field Dressing. According to Colonel Goodwin, every officer and soldier carries a first field dressing. They do not call it a first-aid dressing. In the present British first field dressing, besides the usual sterile gauze, there is an ampoule containing iodine.

There is, therefore, for the dressing of the wounded, their own first field dressing which is carried in a pocket of the right side of the shirt, and the extra dressings carried by the surgeon and the men of the medical corps. It is not noted whether the stretcher-bearers carry any additional dressings.

Colonel Goodwin writes: "The medical officer should direct such of these casualties as are able to walk, to go back, taking shelter, as far as possible, until they meet the stretcher-bearers of the field ambulance bearer division who are coming up from behind. Those wounded who are unable to move should be placed in shelter under shell craters, in trenches, etc., and first aid performed as rapidly as possible. They will be attended to and removed by field ambulance stretcher-bearers on arrival."

It must be recollected that as the battalion advances, so must the regimental aid post be moved forward, and following the regimental aid post, there come the stretcher-bearers of the field ambulance, because the field ambulance also has its stretcher-bearers, as mentioned by Colonel Goodwin above.

It is impossible to describe this moving battalion, or even the attacked battalion in the trenches, or to quote Colonel Goodwin more fully. But the impression which I wish to convey to my readers is that there is not much chance for surgery in the zone of the regimental aid post.

Colonel Goodwin describes the surgery of the regimental aid post as follows: "This is necessarily almost altogether in the nature of first aid, and the placing of the wounded man in the nearest position of shelter. The immediate treatment will consist of:

Arrest of hemorrhage.

Application of first field dressing.

Relief of pain—administration of morphine.

Application of supports to fractured limbs.

For the immobilization of fractures in this front-line treatment, one may utilize the rifle, short pieces of wood and slings.

It is very important to direct all who help in this first-line treatment never to bandage too tightly, never to apply the tourniquet for hemorrhage unless necessary to save life. When the tourniquet is applied, make a careful note on the tally, so that it can be removed at the next dressing station.

According to Colonel Goodwin, the regimental aid post is usually from a quarter to one-half mile behind the front-line trenches and close to the communication trench. In his book he gives an excellent diagram (Fig. 17) of an improvised regimental aid post. Here there are more dressings and apparatus for heating water and milk, but practically nothing more can be done, beyond the first field dressing, with the arrest of hemorrhage,

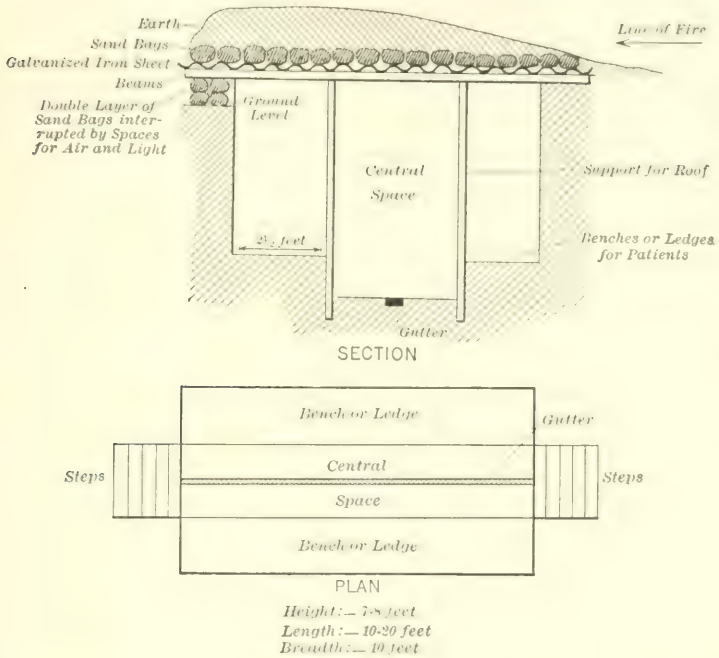


FIG. 17

the relief of pain, and the immobilization of a fracture. If it has been possible to do this before the soldier reaches the regimental aid post, the soldier is not redressed unless it is necessary, but he can be given a hot drink of some kind; if he is very much shocked, he can be kept at the regimental aid post a few hours, and then transported by the field ambulance back.

To one who has never been in the trenches and who has never met a surgeon with experience in the trenches, it is difficult to get a conception of the actual conditions there, and, of course, these must vary with the intensity of the action and the number of wounded.

A properly trained medical-corps man could, if he had the time and when he is not under direct fire, disinfect a wound with iodine or any other antiseptic, cover the wound with the first field dressing of dry

gauze, immobilize the fracture with the rifle or improvised splint, put on a tourniquet for the temporary checking of hemorrhage, and give the man a hypodermic of morphine. If the surgeon were present, it would probably be possible for him, in addition, to rapidly ligate a bleeding artery, or be more thorough in disinfection. However, as I stated before, not much is done for the wounded man until he arrives at the regimental aid post.

If the surgeon is supposed to be with the commander of the battalion, he cannot always be in the regimental aid post unless he has assistants, so that it is quite possible that much of the first field dressing in the regimental aid post has to be done by the medical-corps men.

Colonel Goodwin, in Part III of his book on *Notes for the Military Surgeon*, in describing sanitation in war, pays particular attention to trench sanitation. I would advise every military surgeon to read this in detail. Here one will find some excellent sketches of the different types of trenches.

Field Ambulance Zone. As indicated before, the zone of the field ambulance begins at the regimental aid post and ends at the main dressing station. In the American Army this is the zone of the field hospital.

This field ambulance or hospital is supplied with surgeons, medical-corps men, stretchers and stretcher-bearers. The British field ambulance is composed of 9 medical officers, 1 quartermaster, 241 men of other ranks, 7 motor ambulance cars, 3 horse ambulance wagons, 3 operating tents, and various other carts and wagons for transportation of stores. It is therefore a large unit. It sends its stretcher-bearers forward to the regimental aid post to bring the wounded to the advanced dressing station whence they are moved back by horse ambulance to the main dressing station. The field ambulance in the British Army, according to Colonel Goodwin, consists of a bearer and a tent division.

The bearer division has 3 medical officers, a number of non-commissioned officers, and 108 stretcher-bearers; that is, 18 stretcher squads with 6 bearers to a stretcher. This regulation is often changed by increasing the number of squads to 27, and decreasing the number of bearers for each stretcher from 6 to 4.

In the tent division of the field ambulance we see the first provision for the treatment of the wounded in which it is contemplated that they will remain to be fed and allowed to rest. This tent division consists of 6 medical officers, non-commissioned officers and men trained in nursing, cooking and clerks for records. This tent division mans the advanced and main dressing station.

Colonel Goodwin remarks that the ambulance wagons of this field ambulance are brought forward as far as possible in order to relieve the stretcher-bearers and make their carry as short as possible.

It may even be possible, if the roads are good, to get the ambulance quite near the regimental aid posts.

Later, I shall discuss transportation more in detail. In this zone between the regimental aid post and the advanced dressing station many methods have been improvised to meet the emergencies due to the condition of the ground and the dangers of shell fire.

The moment the wounded reach an ambulance, it is quite possible, if the roads are good, to transport them back directly to the casualty clearing station without passing through the advanced and main dressing stations. Cases properly labelled at the regimental aid posts and demanding immediate operation will probably be transported in this way, if it is possible. It is important to note here that the bearers leave with the ambulance both the soldier and the stretcher, and take from the ambulance an empty stretcher. It is one of the duties of the medical officers in the field ambulance to see that every ambulance which moves to the front carries with it a proper number of empty stretchers.

Another thing for the medical officers to bear in mind, is that the empty ambulance can be used to transport to the front extra dressings and supplies required in the regimental aid post. The regimental medical officer can telephone directly to the advanced dressing station, or send orders back by the stretcher-bearers, but Colonel Goodwin tells me that it is always a good plan to send some extra dressings, especially splints, whether they are requested or not.

The injured man, therefore, is transported back to the advanced dressing station, the main dressing station, or the casualty clearing station. He arrives with the first field dressing and some form of fixation, and a tag indicating the nature of the injury. Colonel Goodwin gives the following directions for what I would call the "second" field dressing: Injection of antitetanic serum 500 units, if this has not been given in the regimental aid post and noted on the tally. Remove the first field dressing. Colonel Goodwin writes that this dressing is usually too tight, either because the first bandage was improperly put on, or it has become too tight, due to the swelling of the limb. He is of the opinion that the first field dressing is always contaminated. Colonel Goodwin's directions as to the second field dressing is as follows: Remove the patient from the stretcher; place the injured limb on a sterile sheet; wear gloves; cleanse the surrounding skin; remove hopelessly torn tissue.

If further action is necessary, give the patient an anesthetic, enlarge the wound, disinfect, drain; ligate bleeding vessels. Do not plug the wound unless it is essential to check oozing, and then make a note of it on the tally.

It is very difficult, even after reading Colonel Goodwin's clear description and after talking with him and others who have been at the front, and after reading all the available literature, to picture exactly what is done, but I am certain there is no uniform rule. It seems almost impossible to expect much of the first field dressing unless it can be carefully applied by the regimental surgeon in the regimental aid post. Although it is possible to do some operations in both the advanced and main dressing stations, or in the field hospital of the American Army, apparently up to the present time the equipment is meager, and the place for operative work seems to be the casualty clearing station of the British Army, or the evacuation hospital of the American Army.

Advanced Dressing Station. The advanced dressing station may be in a large dugout, as it is often in the zone of fire, while the main dressing station will probably be in a building. It is interesting to note that the American field hospital provides tents. I am told that such a field hospital equipment was sent to France in the beginning of the war, and the entire equipment still remains unpacked in the attic of the American Ambulance. As I will discuss later, the automobile hospital is taking its place.

In placing these advanced or main dressing stations, select a place near a good road leading directly to the casualty clearing station; provide, if possible, for two entrances—one for the receipt of wounded, the other for the discharge of the wounded after they are redressed.

The personnel of the advanced or main dressing station should be divided into four sections: *A.* A group having to do with receiving, recording and classifying the wounded. This is a very important function, and the probabilities are that it should be at least superintended by a surgeon. *B.* Nursing group. There will be cases of shock for immediate treatment and some emergency operations to prepare for. According to Colonel Goodwin, no operation should be performed at these dressing stations unless it is urgent. He speaks of operations for the arrest of hemorrhage and tracheotomy, that is, no more than could have been done at the regimental aid post. *C.* Kitchen. Apparently the kitchen only supplies hot drinks—not much more, therefore, than the regimental aid post. *D.* Pack store, apparently for equipment, the arms and ammunition taken from the wounded soldiers, etc.

He remarks that if buildings are not available, it may be necessary to use tents.

He is very clear in his description of everything in this zone of the field ambulance, except in regard to what is actually done in these dressing stations. In his lecture on "The Collection and Evacuation of Sick and Wounded from Front to Base," he¹ writes: "On arrival at the advanced dressing station cases are further treated; dressings, when necessary, are reapplied; splints and immobilizing apparatus may require readjustment, and the cases are sorted into groups, cases with abdominal wounds are despatched, without the least delay, to the casualty clearing station which has been detailed for the reception of such cases."

In his second lecture on War Surgery, he writes of the treatment at the field ambulance and casualty clearing station, but does not differentiate clearly what can or should be done at the two dressing stations—the advanced and main. We now clearly know what should and can be done at the casualty clearing station.

Motor Ambulance Convoy and Casualty Clearing Station. There does not seem much doubt that there will be further development of the motor ambulance for transportation and that the personnel in the casualty clearing station will be increased.

At the present time in the British Army a motor ambulance convoy is

¹ Military Surgeon, June, 1917, xl, 614.

composed of 4 medical officers, 18 non-commissioned officers, then 4 officers and 139 men from the Army Service Corps, 50 motor ambulance cars, 4 touring cars, 8 motorcycles, 4 lorries. The motor ambulance goes as far forward as possible and brings the wounded back at once to the casualty clearing station. An enormous number of wounded can be transported in a comparatively short time.

Casualty Clearing Station. In the United States Army this is called the *evacuation hospital*. In the present war it has really become a hospital, but in the sense that only emergency operations are done here, and then the patients are transported to the base hospital as quickly as possible. It is therefore in this sense a casualty or evacuation hospital.

The British equipment consists of 7 medical officers, 91 men of other ranks, sisters and nurses. Here, for the first time in the zone of advance, we meet women nurses.

Apparently, "Mademoiselle Miss" (published by W. A. Butterfield, of Boston) writes of her experiences from what probably corresponds to the casualty clearing station. The title of the book is: *Letters from an American Girl, with the Rank of Lieutenant, Serving in a French Army Hospital at the Front*.

Goodwin writes: "On arriving at the casualty clearing station the cases are further dealt with. A vast amount of operating is performed in these units, and, at periods when heavy casualties are occurring, it will be found necessary to considerably augment the normal staff of 7 medical officers."

"Matters will frequently be so organized that one casualty clearing station is set apart for the reception and treatment of abdominal or head wounds, all such cases being despatched to this special casualty clearing station as soon as possible."

The necessity for evacuating or clearing "this casualty clearing station" is not due to the fact that the wounded could not be properly dealt with over a longer period of time, but that room must be made for the next batch of injured. The probabilities are, it would be more difficult to administer a larger casualty clearing station than a base hospital of the same size.

Ambulance Trains. Stationary and General Hospitals. The transportation from the casualty clearing station to the Stationary or Base Hospital is usually by train. This hospital is far removed from the zone of shell fire, unless the army retreats. Of course, during the present war these hospitals have the most modern equipment in every way.

If the results are not good in the base hospitals, it is chiefly due to late intervention, and not to lack of surgical skill, or deficiencies in equipment. The ambulance train always carries a personnel of 3 medical officers, 3 nursing sisters, and 47 of other ranks. I shall discuss this later under transportation.

The size of the stationary, or base, hospital is gradually increasing from 500 to 1000 or more patients.

What happens to the wounded after they are discharged from the base hospital will be discussed when I review Colonel Robert Jones' book *Notes on Military Orthopedics*.

War Surgery. Colonel Goodwin's book, from which I have quoted largely in the previous pages, is divided into three chapters: (1) Organization, and Administration; (2) War Surgery; (3) Sanitation. The subject of this book comprised a course of lectures in the Army Medical School in Washington, and these lectures have been published (*Military Surgeon, loc. cit.*).

His short, but excellent resumé of war surgery is of unusual interest, because the author went to France with the First English Army, commanded a field ambulance with a cavalry division during the retreat from Mons,¹ and apparently had experience in every zone, except at the regimental aid post, and this experience continued until a few months ago.

Colonel Goodwin reiterates what all writers mention when he says: "The results of military surgery in the present war have proved disappointing."

Although he mentions Wright's "lymph-lavage" method, we can readily infer that he does not favor asepsis for wounds in this war.

In a modern battle from 5 to 25 per cent. of casualties may be expected. The proportion of killed to wounded is usually about one to four.

If we suppose that a battalion contains 300 men, and each battalion has 1 medical officer, and this entire battalion advances, there would be 75 casualties; about 60 would be wounded and living. These would have to be dressed by the 1 medical officer and 5 medical-corps men. There would be eight stretchers.

According to figures, 20 per cent. would be able to walk, leaving 48 to be carried on eight stretchers, that is, there would be six trips for each stretcher—not a difficult task if the distance is not too great or the ground too rough.

Of these 60 wounded, about 36 to 40 would have wounds of the extremities, and at least one-half of these would be fractures. There would be about 12 wounds of the head, 6 wounds of the chest, and 4 abdominal wounds. One can see from this that it would be quite possible to differentiate, at the regimental aid post, the head, chest and abdominal wounds, and transport them back rapidly to the special casualty clearing station.

It is important also to remember that in the present trench war only 25 per cent. of the wounds are from rifle or machine gun, while 75 per cent. are from shells.

Shock. Colonel Goodwin writes that in every convoy of wounded will be found a certain number of men suffering from shock due to hemorrhage, exposure to cold, wet and hunger. The proper treatment of these cases is often difficult, and transportation delayed, due to the large number of wounded and the heavy shell fire.

Shock is more frequently observed when the wound involves the abdomen or chest; or when there is a large soft-part wound with compound fracture of the femur; or when the wounds are multiple, and

¹ Military Surgeon, August, 1917, xli, 169.

yet each single wound may not be serious. Long and rough transportation may aggravate the shock.

He suggests that in cases of this kind the patient should be allowed to rest one or two hours, even postponing the dressing or examination unless there are indications for this interference. Some cases will be able to take hot nourishment by mouth, but when this is contra-indicated by nausea or vomiting, give *per rectum* warm salt solution with glucose. When the shock is extreme, saline should be given subcutaneously. As to drugs, he only mentions pituitary extract.

Wound Treatment. For small, superficial wounds with no gross infection, Colonel Goodwin advises 2 per cent. iodine and a dressing of dry antiseptic gauze. For extensive, foul wounds, he recommends a moist dressing. The gauze may be wet in carbolic acid 1 to 60, sodium chloride 5 per cent., lysol 1 dram to the pint. Provision should be made for free drainage. Fractures should not be bandaged, except over a splint. The wound should not be sutured. In retaining the wet dressings over these extensive wounds, the many-tailed bandage is more useful than the roller bandage.

He speaks of the fact that some of these extensive, foul wounds should have been thoroughly cleansed with the patient under an anesthetic at one of the dressing stations, or at the casualty clearing station. When this has not been done, or if the wound is still extensively foul after it has been done, more extensive procedures may be indicated at the casualty, or base, hospital. The wound is enlarged, the dead marginal tissue cut out, foreign bodies removed, counter-incisions made, if necessary. He expresses the opinion that at this third dressing, when the wounds are foul, powerful antiseptics are not desirable.

Colonel Goodwin then describes Sir Almroth Wright's method, but advises that in the majority of cases carbolic acid in 2 per cent. solution should be added to the salt solution. Baths and continuous irrigation have proved useful in deep sloughing wounds. Sunlight stimulates the wound when it is granulating. Good results have been observed from flavin and hypochlorous acid, or eusol.

The Carrel-Dakin treatment is described last, because he considers it the most important, and states that it has supplanted all other methods of treatment to a large extent in the British hospitals. I emphasize this statement of Colonel Goodwin, because one American writer has made the emphatic statement that the Carrel-Dakin method has not been employed, except in isolated instances, by British surgeons. I am glad to have this opportunity to publicly correct this statement.

We will not quote here Colonel Goodwin on the Carrel-Dakin treatment, because I expect to extensively review Carrel's and Dehelly's book on *Infected Wounds*.

Gas Gangrene. Colonel Goodwin's description is so clear and brief that I am sure it will be helpful to young military surgeons who have not encountered this distressing wound complication. The symptoms usually occur within the first three days. They may appear within a few hours. In a few cases the onset may be delayed several days. The symptoms are crackling, brownish discoloration, or the so-called

bronzing, of the swollen, tense limb, with foul gaseous discharge, offensive odor, the general symptoms of extreme degrees of intoxication—cold extremities, low blood-pressure, dry tongue, subnormal temperature. The treatment should consist of free incision, removal of dead tissue, through cleansing of the wound, hydrogen peroxide, drainage. If the extremity is warm do not as a rule amputate. If they are cold and insensitive amputate at once.

Tetanus. This was a serious factor only during the first few months of the war. Five hundred units are now injected at once, and this dose is repeated at the base hospital, in all severe wounds. If symptoms develop, give 3000 units and repeat every second or third day. The risk of anaphylaxis is not serious.

Wounds of Large Bloodvessels. His short summary corresponds pretty closely with the conclusions reached by me in previous numbers of *PROGRESSIVE MEDICINE*. He writes: "Primary ligation of the large vessels is rarely necessary and always undesirable. In arterial hematoma, operation may be indicated because of secondary hemorrhage, continuous increase in size of the pulsating swelling, secondary diffusion, threatened gangrene from pressure, threatened suppuration. The operation of choice is ligation of the artery above and below the injury. In arteriovenous aneurysm the indications for operation are practically identical, and the operation of choice is the same. In aneurysmal varix, the majority of cases do well.

Fracture. The splints recommended and illustrated by Colonel Goodwin are: Captain Colin Mackenzie's¹ splint for compound fracture of the humerus. This splint is not described or pictured by Colonel Jones, who prefers a modified Thomas splint.

Page's thigh splint (Fig. 20). This splint is not mentioned by Jones.

Thomas's splint (Fig. 19). This is a form of apparatus very popular in the British Army, and I will describe and illustrate it in my discussion of Colonel Jones's book, when I will also consider his abduction frame for use in pelvic and gluteal wounds. This is illustrated and described by Goodwin.

These splints—Mackenzie's, Page's, Thomas's, and the different types of Jones's abduction frames, are splints that can be furnished to the regimental aid posts; they can be carried there by the field ambulance and its bearers who go to the regimental aid post without the burden of the wounded man. These splints can be adjusted rapidly and, so far as I can learn, are the best means of fixation which will allow redressing of the wound without disturbing the fixation apparatus.

The British medical service supplies to the zone of advance, from base hospital to regimental aid post, material for making metal field splints. They are packed somewhat like children's blocks in the field fracture box; they consist of five-foot lengths of mild steel, drilled with holes at one-inch intervals; split steel rivets go with these drilled laths of steel. In the different dressing stations these splints can be made up in the quiet periods. Fig. 20 illustrates the method of putting these

¹ *Lancet*, March 25, 1916.

splints together. I am informed that the French use aluminum splints, but I gathered from conversation with Colonel Goodwin that this mild steel is cheaper than aluminum and just as easily and quickly riveted and molded into the splint desired for a special purpose.

Plaster of Paris is not recommended by Colonel Goodwin and is practically condemned by Colonel Robert Jones.

I would advise industrial surgeons in this country to purchase a number of the splints recommended by Goodwin and Jones, and illustrated in their books, and try them out.

General Treatment. In compound fracture, unrestricted drainage. Never bandage the limb without first applying a splint, padding it well with wool. When the wound is from a rifle bullet with a small wound of entrance and exit, and no extravasation of blood, cleanse the wound, dress and immobilize. But when the wound from the rifle has an exit wound of the explosive type, explore under anesthesia, remove foreign bodies, blood clots and any completely detached fragments of bone. There seems to be much difference of opinion as to what to do with the completely detached fragments of bone. Colonel Jones takes it out, washes it in alcohol and puts it back. Then open the wound freely, irrigate, cut away dead tissue and excise the edges of the skin wound; drain thoroughly. Keep the drainage tube from contact with large vessels, and do not let them pass through defects in the bone. Do not use gauze wicks. The best form of irrigation is the Carrel-Dakin.

This treatment of a compound fracture represents the methods pretty universally employed, but I get the impression that success depends upon how early after the first field dressing this treatment and drainage are introduced, and on the most minute attention to the details of drainage and irrigation.

Later, I will point out that the ultimate restoration of function depends largely upon the surgeon's knowledge of military orthopedics, now so thoroughly established by Colonel Robert Jones.

When the fracture is caused by a shell or deflected bullet, enlarge the wound, cleanse, establish free drainage. When there is only a wound of entrance, make a counter-incision for the removal of clots and drainage.

Fracture of the Humerus. As a primary field dressing one can use short wooden splints and bandage the arm to the side, Mackenzie's splint (Fig. 18) or Thomas's splint. At the base hospital these splints may be continued, or Page's splint substituted. Then Colonel Goodwin mentions Strohmeier's cushion. He does not illustrate it, and it is not pictured or discussed by Colonel Jones.

Fracture of the Femur. In the zone of advance, if possible, anesthetize, apply extension and immobilize in a Thomas knee splint (Fig. 19), or a Page splint (Fig. 20). When the patient reaches the base hospital, make counter-extension and continue the Thomas splint. When the fracture is near the hip-joint, employ Robert Jones's abduction frame. Colonel Goodwin, in speaking of the Balkan splint, is of the opinion that it is difficult to maintain sufficient extension with it, while the

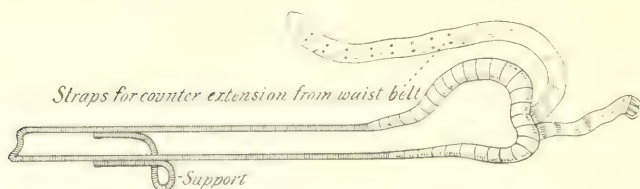


FIG. 18.—Captain Colin Mackenzie's splint for compound fracture of the humerus. (Described in the *Lancet*, March 25, 1916.)

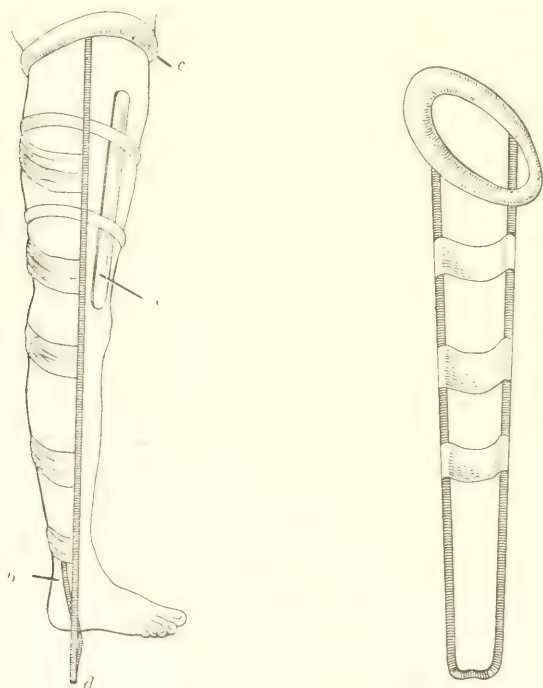


FIG. 19.—Thomas's knee splint applied for fractured femur, reinforced with short thigh splints. Mode of application: (a) Strapping of adhesive plaster is applied to the sides of limb, omitted, for the sake of clearness, in the figure. (b) At the lower end of extension strapping is attached a length of stout bandage. (c) The ring of splint is passed over the foot and up the limb until it rests firmly against the tuber ischii. (d) Pull the extensions tight, turn ends round each side bar and tie over lower end of splint. (e) If desired, local splints may be applied to the thigh. The skin of the buttock should be attended to by the nurse every day, the skin being pressed, and a fresh portion drawn under the splint.

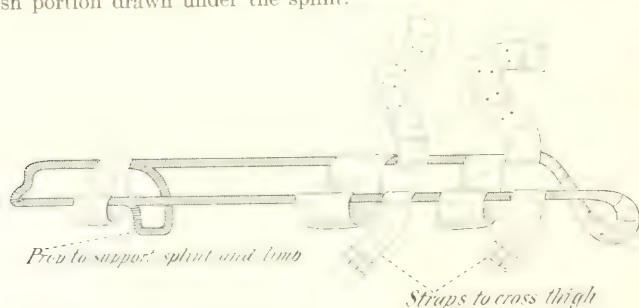


FIG. 20.—Page's thigh splint. This splint may be readily made up from the metal strips in the field fracture box.

Hodgen wire suspension splint needs constant attention and readjustment. The long Liston splint should not be used during transportation, because the perineal band causes considerable swelling. If one has nothing but this splint, he emphatically says: "Leave off the perineal band during transit." Page's splint can easily be made up from the bands of mild steel and can therefore be substituted when the Thomas splint is not available. This Page's splint made of mild steel can be bent into shape like a Hodgen splint if flexion at the hip- and knee-joint are desired.

Apparently, Goodwin and Jones agree pretty well as to splints. Colonel Goodwin does not mention plaster of Paris. Colonel Jones writes: "I would not condemn the use of plaster altogether, much as I dislike it, but it should be used with discrimination. It should be fixed in such a way that the limb remains in extension and in good alignment, and that the circulation of the limb is in no way hampered."

Indications for Amputation. This may be called for as a primary measure when a limb is hopelessly shattered, when it is gangrenous from arterial injury, or when advanced gas gangrene has set in. As a secondary measure, amputation may be necessary, because the wound is taking an unfavorable course. Carrel in his book quotes Tuffier's statement which is now well known throughout the literature of this war. Tuffier found that 70 per cent. of amputations were necessitated by the infection and not by the extent of the anatomical lesions.

Knee-joint. Wounds of the knee-joint are more serious than those of any other joint. A treatment successful here will probably do for any other joint. The types of injury to the knee-joint are as follows:

1. Effusion without lodgment of the bullet in the joint. In cases of this kind it may be difficult to tell whether the bullet has passed through the synovial cavity or merely bruised the synovial membrane. A bullet may perforate the synovial sac without injury to the bone, or the bone, one or more, may be similarly perforated.

In cases of this kind be conservative. If there are effusion and signs of infection, aspirate and study the effusion bacteriologically; act on the findings.

I am most interested in this statement of Colonel Goodwin, because this is what I have advocated in PROGRESSIVE MEDICINE since 1899, and I got this from the teaching of Dr. Halsted, Professor of Surgery at the Johns Hopkins Medical School.

2. When the bullet has lodged in the synovial cavity or in one of the ends of the bone and the wound is small and there is no sign of infection, leave alone until healing has taken place. However, if there is a free fragment of a shell, or a distorted rifle bullet, remove it at once irrespective of symptoms.

3. When the synovial cavity has been opened, carefully disinfect; drain, if indicated; immobilize. (In my experience, I agree with Halsted that drainage of a joint cavity is not a good thing, unless it must be done. Rubber is always better than gauze. I have found, if the wound is left open for irrigation, one can usually dispense with drainage tubes.)

4. When the patella is fractured, it is possible to remove the fragments and suture the synovial membrane, but when the ends of the femur and tibia are comminuted, the majority of cases require amputation, although some good results have followed excision. Colonel Goodwin has had the most satisfactory results with *flavin* in wounds of the knee-joint.

When the wound of the knee-joint is seen at the front, the tissues are shattered and soiled, and the main vessels and nerves torn, amputate there at once. In other cases disinfect the skin, remove visible and palpable foreign bodies; do not employ drainage tubes at this stage. Fix in a Thomas knee splint; never use a short splint. When the patient arrives at the casualty or base hospital, shave and thoroughly disinfect the skin again, immobilize the joint in slight flexion; take *x-ray* pictures. If there are signs of infection locally, or bacteriologically, open the joint, remove foreign material, excise the wound, use Carrel-Dakin, and not strong antiseptics.

When there is only effusion, high temperature does not necessarily mean infection. Aspirate, however, always and examine bacteriologically. Repeat aspiration if effusion reforms. If cultures and coverslips are sterile, do not operate; if infected, try first, after aspiration, injections of formalin-glycerin 2 per cent., or iodoform-ether.

(In my experience, as recorded in *PROGRESSIVE MEDICINE*, the quickest results when the effusion contains bacteria are obtained by immediately performing arthrotomy and irrigation of the joint.)

Head Injuries. We have noted before that the percentage of head injuries will be from 10 to 20. These cases should receive first field dressings and be selected for rapid transportation back to the first station equipped for operation, usually the casualty clearing station. Colonel Goodwin emphasizes the fact that in apparently superficial head wounds there may be extensive splinters and depression of the inner table of the skull. He does not describe the primary first field dressing.

The object of operative interference is the relief of cerebral symptoms, prevention of future complications. The nature of the operation, in the majority of cases, is cleansing the wound, removal of bone fragments and foreign bodies. In the technic of the operation, excise the scalp wound, irrigate with hot salt during the operation, remove bone fragments, and when there is intracranial pressure, make a large bone flap. All of these cases require drainage. The drain advised is a perforated metal tube. According to Colonel Goodwin, decompression is rarely called for in the early stage of a wound. The probabilities are that the skull is fractured and comminuted, and the blood has an outlet. Earlier intervention, with excision of the scalp wound with the removal of bone fragments, cleansing the wound and drainage, will probably prevent, in a large number of cases, the secondary complications due to infection.

From this description one can see that the operative intervention in the early stage of head wounds is not a very difficult or formidable procedure, and could be done at the main dressing station.

Spinal Injury. As in civil practice, so in military surgery, treatment is disappointing. When the x-rays show a fragment of bone or shell in the spinal canal, operate. Colonel Goodwin advises that the urinary bladder be irrigated with a solution of quinine sulphate, 2 grains to the ounce. This is, of course, designed to prevent urinary infection.

Wounds of the Chest. If the soldiers do not die at once, the prognosis is good, even if they are considerably shocked. There may be emphysema. The important elements of first treatment are rest, morphine, very small quantities of food. Do not transport for at least a week. Do not aspirate the hemothorax during the first week. Of course, when the hemothorax becomes infected, it must be promptly drained as for emphysema. The troublesome bronchitis is apparently relieved by iodide of potassium and carbonate of ammonium, 3 grains of each. (In the early days after a chest injury this mixture may upset the stomach, and should then be discontinued. Morphine in small doses is the most helpful drug.)

Abdominal Wounds. According to Colonel Goodwin, a large proportion die on the battlefield.

Wounds of the *liver* and *kidney* usually do well and seldom require operation. If there is much bleeding in the latter, nephrectomy should be performed. The indications for operation on wounds of the *small intestine* are: Time within twenty-four hours; certainty that the peritoneal cavity is opened; patient's symptoms are becoming worse; conditions for operation satisfactory. Before closing the abdomen search carefully for any bleeding-point.

Trench Foot and Frost-bite. This distressing wound is due to long exposure to cold and wet in soldiers whose general circulation is lowered by their depressing environment, and, in addition, the circulation of the limbs is interfered with by tight shoes and boots. In lighter cases there is but anesthesia and edema; in second-grade cases there are cyanosis, edema with bleb formation; in the worst cases, gangrene.

Preventive Measures. In winter, especially on cold, wet days, everyone exposed should wear looser boots which have been thoroughly greased; even the puttees should be more loosely applied. Socks should be changed more frequently and the feet kept dry. Apparently, rubber boots are better for this exposure than the ordinary army shoe or boot. In addition, the feet and legs should be greased. Men exposed should be given hot food more frequently and urged to keep in motion.

During last winter the British adopted a French method under the term Trench-foot Wash Houses. These laboratories were two or three miles behind the foremost trench. The men of one company at a time, before going into the trenches, reported at these wash houses and washed their feet in the following preparation:

Soft potash soap	1000 parts
Powdered camphor	25 "
Powdered borate of soda	100 "

While this toilet of the feet was going on, the regimental chiropodist treated the corns and abrasions. The feet were thoroughly dried and

dusted with a powder composed of camphor, talcum and boracic acid. This treatment was a great improvement over the greasing of the feet, and the men preferred it.

One can see that Colonel Goodwin is somewhat skeptical, that even methods of this kind will prevent trench foot, if the soldiers are allowed to remain in the trenches too long at a time.

Gas Poisoning. Colonel Goodwin observed some of the first cases in April, 1915. The gas was chlorine, and the British and French armies were unprepared. The losses were serious. At the present time both the allied armies are well protected, and the losses are slight. Apparently, the German gas has changed, and late or delayed effects are being observed. That is, the gassed soldier is apparently doing well, when, after a few days, death takes place suddenly, with all the symptoms of acute pulmonary edema. Protective measures are most important, because the treatment of gassed cases is not satisfactory. In brief, it is: Rest, oxygen, stimulating expectorants, such as carbonate of ammonium (atropine and ipecac are contra-indicated), venesection, if there is marked cyanosis.

Sanitation. I wish it were not out of place to review here this section of Colonel Goodwin's book. It has to do chiefly with sanitation in the trenches. With this form of sanitation our army and its medical officers have had no experience.

I handed this chapter to one of my friends in the Health Department of Baltimore. He read it with the greatest interest and profit, and I gathered, from his comment, that all public health men in this country should familiarize themselves with the details. There is apparently no question that through medical science and human ingenuity, combined with a great deal of common-sense, armies have been protected in the worst possible environment in which a human being can live, and one cannot help remarking that perhaps many of these soldiers were better protected by the medical corps of the army in the trenches than they were at home by the public health departments. But it must be added here that the medical department of the army was given the authority and the means—conditions up to the present time rarely accorded public health departments.

It seems quite likely that the drawn game of the war in the trenches so far has been due to the fact that medical science has been equally distributed and all the armies on the western front have been equally protected from disease.

First Aid in War. In *PROGRESSIVE MEDICINE* for December, 1915, I reported in detail in regard to the First-aid Conference held in Washington, August 23, 1915 (p. 217). A Board of Standardization was appointed by the President at that time, and the results of their two years' work is about to be published. I may get the manuscript in time for a brief review, but at the present writing it is not available.

In *PROGRESSIVE MEDICINE* for December, 1916, I gave a brief note on the progress of first aid in industrial medicine and surgery, and a very brief reference to first aid in war (p. 249).

In a careful study of the literature since the beginning of this war,

in correspondence and conversation with men who have been at the front, I have been able to obtain very few data.

I have only met one medical officer who spent some time in the trenches. Surgeons there apparently do not write.

In conversation with Dr. Alexis Carrel, of the Rockefeller Institute, a few days ago, he gave as his opinion that it would be ideal, if it were possible, to have but one dressing, and then transport the patient to the nearest hospital where an operation, if indicated, could be performed under anesthesia in the proper environment. The time between the first dressing of the injured man and his admission to this hospital should be as short as possible. This primary dressing should consist of the application of sterile gauze to the wound, and the fixation, if the injury is to the extremity, of a simple, quickly applied splint.

Hartman, a graduate of Johns Hopkins, wrote me recently that many of the wounds of the extremities are most efficiently dressed at the regimental aid post and transported back rapidly to the hospital. In dressing the wounded man, the clothes and shoes are not removed; the clothes are cut to expose the wound. The wound is covered with dry gauze. The lower extremity is fixed in a Thomas splint, using the shoe for extension. Hartman says that these patients are transported with comfort. A modification of the Thomas splint is used for the upper extremity. Abdominal, chest and head wounds receive a simple dressing and are transported back rapidly to the nearest hospital if operation is indicated.

In the beginning of the war all the surgeons at the base hospitals commented unfavorably on the frequent change of dressing and the many applications of iodine. Apparently, to a large extent, this has been improved. However, it is very difficult to get at the exact facts.

At the present time the chief difficulties are, first, getting the wounded man to the first-aid station; second, to transport him back rapidly. All authorities seem to agree that at the first dressing station nothing could be done beyond the application of a first dressing of sterile gauze and the fixation of the extremity. An operation under an anesthetic here is practically impossible. Of course, the patient can be given a hypodermic of morphine for pain, the antitoxin for tetanus and gas bacillus can be administered. But for anything beyond this there is no time and not the proper environment.

It might be possible to inject some of the wounds and deeper cavities with some antiseptic fluid, or antiseptic paste. In fact, the probabilities are that this has been tried. Carrel, however, is of the opinion that nothing could be expected of the application of any antiseptic known at the present time. The wound is filled with blood, foreign bodies, torn and lacerated tissues, and the probabilities are that there are cavities and recesses into which no antiseptic could be forced. These huge wounds require opening under an anesthetic, the removal of foreign bodies, a careful dissection and removal of the torn and dead tissues—an operation which could not be done at the front, nor even at the first and second dressing stations.

It is to be remembered that the simple bullet wounds do well under

the ordinary first aid and fixation, but in this war the number of such wounds is relatively small.

Then again, in modern warfare fighting is not continuous, but intermittent. Colonel Goodwin describes it as "long periods of inactivity and short periods of hell." Given the largest medical personnel, the number of wounded during the period of activity is so great that there is only time at the front to do the things I have mentioned.

In the report of results of different treatments, as a rule we know the number of hours elapsed between the time of the primary dressing and the time the patient reached the hospital for the thorough treatment. But I have been unable to ascertain whether any record is kept of the actual time which elapses between the receipt of the wound and the first-aid treatment. In some cases it might be possible to apply the primary dressing in a few minutes; in others the patient may remain untreated for hours, even a day or two. None of the first-aid tags record the time of the injury, only the time of the primary dressing. Then again, there is no record of whether the individual wounded man was the only one, one of a few, or one of a great number treated at the regimental aid post. The efficiency of this primary dressing must be influenced by the number of wounded to be dressed in a certain space of time by the regimental medical personnel. It is quite true that this personnel may be increased, but, nevertheless, this factor of the number of wounded must be considered in estimating the results of treatment. Then, while the transportation may not take a very long interval of time, it may be rough and painful. The general condition of the patient and the local condition of the wound are tremendously influenced not only by the time, but by the character, of the transportation. That a soldier comes to a hospital with a Thomas, or any other splint, is not a positive indication that the splint has been properly applied. Its application may have increased pain and hemorrhage; it may not have prevented movement of the broken bones. The possibility of exposure to cold, and the absence of liquid nourishment during transportation are factors which would influence the results.

A study of the literature on the results of the same wound treatment with the same methods, impresses one with these other factors.

The cause of the failure may lie with any one of the factors which have acted before the patient received the operative treatment in the nearest hospital to the rear, and have nothing to do with the treatment there. Yet, in the contributions of surgeons who are advising different antiseptics and different methods of treatment, these other factors are not considered. It is surprising to see that in almost any type of wound treated by almost any well-known method, ideal results have been obtained. In cases of this kind one must naturally conclude that something from the time of the infliction of the wound to the time of the operative treatment had not taken place in the group with good results, but has occurred in the group in which the results were less satisfactory.

In spite of every attempt, it seems impossible, up to the present time, to change the methods of wound treatment in the zone of advance

so far as the medical personnel is concerned. The soldier is dressed by one group of surgeons in the regimental aid post, and then passes to the rear. During this transportation and before his ultimate recovery, he comes under the supervision of a number of groups of surgeons, each one of which may prefer a different antiseptic, a different method of drainage, and a different fixation splint. Only the last group know the results of their treatment. If the results are not good, they can place the discredit to the treatment received before the soldier came under their care. If the result is an ideal one, they may incorrectly claim the credit for themselves, while the result was really due to something that had been done before, or to something that had not happened.

We cannot expect as much from first aid in war as we can from first aid in industrial practice, and, as I will discuss later, we have not as yet ascertained the real value of first aid in industrial injuries when this is applied by a lay individual.

Surely, the fighting soldier has not the time, nor the environment to do much for his injured comrade. His business is to fight. The probabilities are that a soldier can be taught as well, and perhaps better, than an industrial worker about first aid. But the modern soldier has so much to learn, and as at the present time we have no evidence that first aid by him will do any good, it seems just to conclude that it would be far better to spend more time in instructing him in regard to personal hygiene, the care of his feet, and how to keep well, than how to dress his own or his comrade's wound.

It is the responsibility and duty of the medical officers and personnel assigned to the regiment to look after the wounded. The sanitary corps and stretcher-bearer should receive special instructions in the dressing of wounds, in the application of splints, and in the various methods of transporting wounded men.

FIRST-AID PACKAGE. In the American Army every soldier carries a first-aid package consisting of gauze impregnated with bichloride of mercury to which is attached a bandage. There is no reason why this should be discontinued, and no reason why the soldier should not be instructed how to apply it to himself or to his comrade.

Colonel Goodwin, the representative of the British Army in the Surgeon-General's Office, Colonel Russell and myself were recently appointed by the Surgeon-General to go over the United States first-aid package and first-aid instructions given the American soldier. After considering the question from every stand-point, it was decided that there was no available evidence to justify any change. The present first-aid package is the most durable provided to any army, as it is packed in a metal case. When these are exhausted, the probabilities are that the metal case will be discarded. We had nothing to justify placing iodine in this first-aid package.

The British first-aid package contains an ampoule of iodine, but Colonel Goodwin was rather of the opinion that this would be changed, as there seems no reason for the soldier to apply iodine himself. It is therefore an unnecessary expense.

The British first-aid package devised by Colonel Goodwin seems to

present one distinct advantage over ours, because the color of the gauze pad, which is to cover the wound and which should not be handled, is different from the color of the bandaging part, so the one who applies it can readily distinguish by this contrast between the part that may be handled, and the part that must not be handled. The bandage is stained a light brown, the dressing is slightly pink, or blue. The probabilities are that when we need more first-aid bandages for our army, this idea will be adopted.

The larger, so-called shell dressing, is not given to the soldier, but to the medical-corps man.

FIRST AID FOR THE TRENCHES. This little book was written in 1916 by Captain Somerville Hastings, Royal Army Medical Corps (The George U. Harvey Publishing Co., Inc., 107-109 Lafayette St., New York). I am informed by Colonel Goodwin that this is not an official publication and that, so far as we know, Captain Hastings has not observed its practical application in the trenches.

However, it is the only book that I can find dealing with this subject, and for this reason it should be carefully considered.

I do not know whether I am the one to judge, but it impresses me more as a book for the members of the medical corps and not for the soldier. Captain Hastings remarks that the book contains some simple instructions for saving life that every soldier should know.

Every soldier is liable to be wounded and, if no doctor or stretcher-bearer is present in order to render skilled assistance, the man himself or his comrade should have some slight knowledge of the simple facts. In this book he states not only exactly what should be done, but also why.

There are five chapters in the book entitled: Wounds; Broken Bones; Unconsciousness, Suffocation and Burns; On Moving Injured Person; On Help in the Trenches.

Wounds. Here are discussed shock, bleeding, and the poison of wounds. It is undoubtedly important that every individual should understand how bacteria get into an open wound. This should be part of the instruction in personal hygiene. In regard to shock, Captain Hastings calls attention to the proper position, and keeping the wounded man warm, and that if he is bleeding, he better not be moved. However, in modern warfare it may be absolutely essential to remove the wounded to a place of safety. The danger of further injury may be greater than the danger of transportation.

Captain Hastings writes: "If the patient is conscious he can be given soup, tea or coffee." As I understand it, such hot drinks are rarely available until the patient reaches the regimental aid post. The only drinkable that a soldier should have on his person is the water in his canteen.

Now Captain Hastings comes to the most difficult problem—how to teach the soldier the necessity of not handling the wound. He tries to impress upon his readers the importance of non-interference. Then, again, he cautions them to try to keep themselves and their underclothing clean, because particles of both will be carried into the wound. He

then mentions how the Japanese took carbolated baths and steamed their clothes before going into action. So far as I know, no provision has been made for this in the trenches.

Then Captain Hastings writes: "If you are able you should try to destroy the poisonous germs in a wound by pouring into it tincture of iodine." I have just noted Colonel Goodwin's opinion that this iodine should no longer be furnished the soldiers. The majority of authorities are against putting iodine in the hands of soldiers or industrial workers.

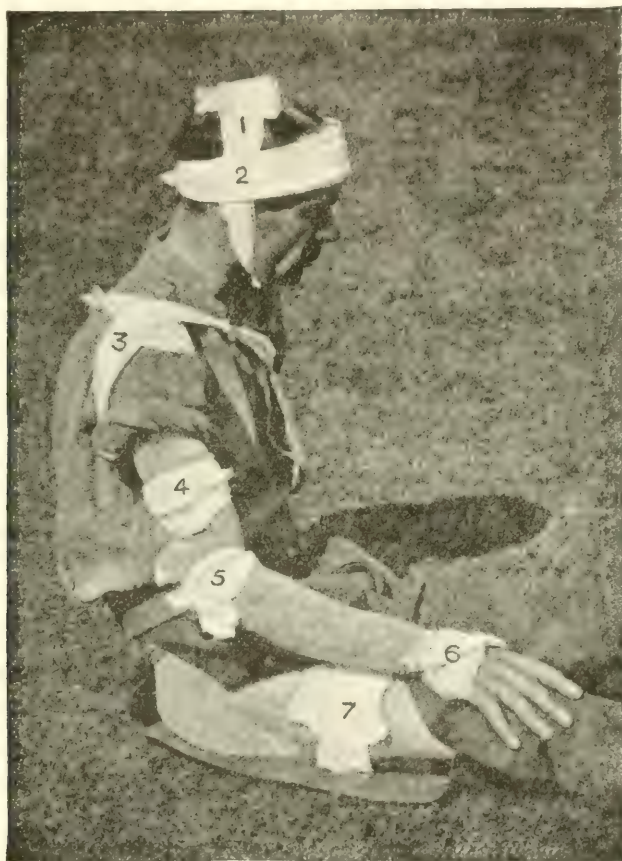


FIG. 21.—Handkerchiefs applied as bandages for wounds of (1) head, (2) forehead, (3) shoulder, (4) arm, (5) elbow, (6) hand, (7) thigh. (Hastings, *First Aid for the Trenches*.)

Then Captain Hastings describes how to apply the first-aid dressing, which apparently all agree that the soldier should understand.

Bleeding. This is the dilemma of all first-aid books. However, these elaborate descriptions with illustrations appear in every first-aid book. From my study of the question, I am impressed that the chief difficulty is to instruct the lay mind when the bleeding is sufficient to justify measures to arrest it. The treatment of bleeding by a tourniquet is

not difficult to teach, but this method has an element of danger—if it does not check the artery, it increases venous hemorrhage; if it does, the circulation to the limb is completely cut off, and the tourniquet must be removed within one or two hours. I am rather of the opinion that the number of lives which will be saved by teaching laymen how to check hemorrhage with a tourniquet is too small as compared with the risks of the life of the limb in the large number of individuals who would have the tourniquet applied needlessly.

Fig. 21 illustrates the application of handkerchiefs as bandages for wounds in different parts of the body. But the British first-aid package does not contain this handkerchief, but a bandage of a different kind. Von Esmarch favored this form of first-aid dressing, and many



FIG. 22.—Tourniquets on arm and thigh. (Hastings, *First Aid for the Trenches*.)

authorities today are of the opinion that the package, both for the soldier and industrial worker, should contain, in addition to the one now supplied, an Esmarch handkerchief bandage and at least one roller bandage. Our medical-corps men have all three. A former First-aid Commission of the United States Army recommended this handkerchief bandage as well as an ampoule of iodine, but this recommendation was not adopted.

Fig. 22 shows how the tourniquet should be applied to the arm, leg, and thigh; Fig. 23, digital compression of the temporal artery with a compression bandage on the head for bleeding from the scalp. Fig. 24 illustrates how to compress vessels of the neck; Fig. 25, how to compress the subclavian; Fig. 26, the femoral artery below Poupart's. . . .

No doubt hospital-corps men and stretcher-bearers should know these methods, but it is a question whether the soldier should.

Broken Bones. Here again we are confronted with the question whether it is worth while to teach the soldier or industrial worker the simpler methods of temporary fixation of a fracture of the upper or lower extremity. The consensus of opinion indicates that this is far more important than any instruction on hemostasis. Figs. 27 and 28 illustrate the methods advised by Captain Hastings for fracture of the

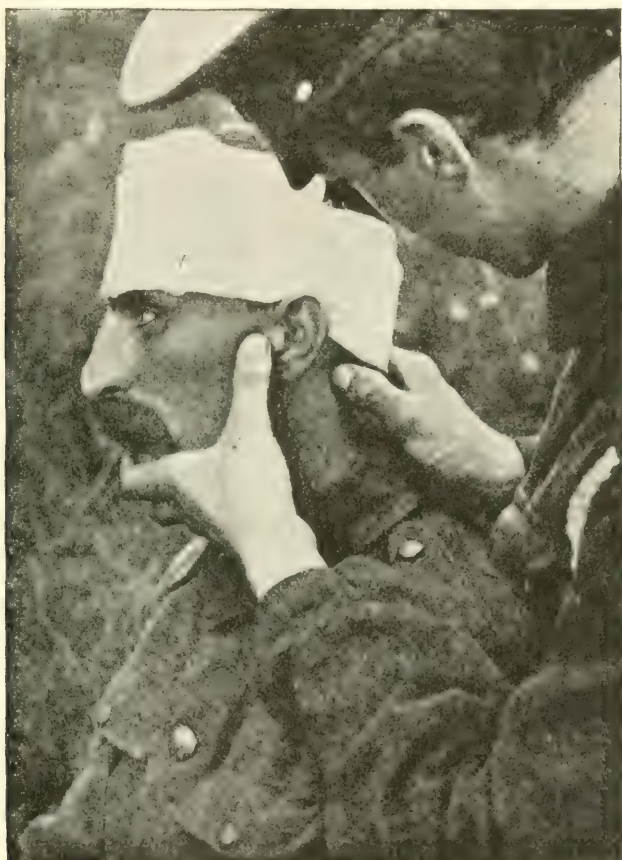


FIG. 23.—Pressing on bloodvessels of head to stop bleeding. (Hastings, *First Aid for the Trenches*.)

forearm. This would do as a temporary splint for any fracture of the upper extremity. Figs. 29 and 30 picture how the upper extremity can be comfortably fixed by the sleeve of the coat or the tail of the overcoat. I am very much impressed with the importance of instructing laymen and soldiers in these simple matters illustrated in Figs. 27 to 30.

In Figs. 31 and 32 we have portrayed how the rifle or the board of a ration box can be utilized for a fracture of the lower extremity. In my

experience, for fractures of the leg in industrial injuries, a pillow or blanket is the best means of fixation for the transportation. In military practice, a coat will do. When the fracture is of the thigh, and there is a stretcher, the patient can be placed on the stretcher, the limbs pulled straight and bandaged together, the uninjured limb acting as a splint.

When splints pictured in Figs. 31 and 32 are applied by a layman or a soldier, the bandages are apt to be tied too tight. This danger is not present in applying the sling for the forearm.



FIG. 24.—Pressing on bloodvessels of neck for wound of neck. (Wound not shown.)
(Hastings, *First Aid for the Trenches*.)

Fig. 33 shows a simple bandage for fracture of the lower jaw. A single turn of the handkerchief is just as good. The first-aid package makes an excellent temporary bandage for fractures of the lower jaw, and there is no doubt that this little support gives comfort.

Unconsciousness, Suffocation and Burns. It is not at all difficult to instruct the layman how to tell when an individual is unconscious, but to teach him the differential diagnosis as to the causes is impossible. Captain Hastings attempts to describe unconsciousness from concussion or stunning, from shock or loss of blood, from suffocation and gassing,

and pictures methods of artificial respiration. I am inclined to the opinion that it is not worth while to attempt instructing an army in artificial respiration. The problem will be difficult enough with the hospital corps and stretcher-bearers.

Captain Hastings advises for a burn to cover it with a moist dressing. He does not state what it should be moistened with. I am inclined to think that burns and scalds should be left alone until they come under the care of the medical personnel.



FIG. 25.—Pressing on bloodvessel behind collar bone for bleeding from wound of shoulder. (Hastings, *First Aid for the Trenches*.)

On Moving Injured Persons. This is an excellent chapter, as it describes methods of transportation when the stretcher and bearers are absent, or when it is impossible, on account of the narrow trench with sharp turns, to use a long stretcher.

The photographs (Figs. 34 to 56) are so excellent that they need no description beyond the legend.

These photographs demonstrate that the simplest method of teaching is through an illustration, and motion pictures of this kind could be part of the entertainment of soldiers during the periods of inactivity. The probabilities are that this will be arranged for our troops in France.

According to Colonel Munson, of the Medical Department of our army, motion-picture theaters are to be supplied to all our training camps for instruction and entertainment.

On Health in the Trenches. This is a very important and interesting chapter, and, after reading it, one wishes that the chapter on hemorrhage had been shorter or omitted, and this one lengthened. Captain Hastings emphasizes the importance of prevention. In civil life we know how difficult it is to impress the public that the best treatment for any illness is not to get it.

Sore Feet. Even when the boots fit well and are not new, the feet should be washed at least after every twenty miles of marching. The socks should fit well and be washed frequently.

The details of the preparation of the feet for the trenches are given by Colonel Goodwin on page 237.



FIG. 26.—Pressure on the artery in the groin for bleeding from wound of upper part of thigh. (Hastings, *First Aid for the Trenches*.)

Boils. Prevention depends upon frequent bathing, avoidance of constipation, and of excess of meat in the diet.

Soreness in the Crutch. Keep the parts here clean, use a powder. Cotton underclothing is better than woolen.

Trench Fever. Captain Hastings seems to think that one of its causes are dirty mess tins, and urges constant cleanliness.

Lice. If the war literature can be considered accurate, lice must be as great a nuisance on the firing lines as flies and mosquitoes in some of our camps. We now know that flies and mosquitoes can practically be eliminated by proper sanitary precautions. The best prevention against lice is clean underclothing. Rountree, Professor of Medicine of the University of Minnesota, is investigating this problem. It is not

always possible for a soldier to get a daily bath, or to boil his underclothing, but it seems possible to impregnate the underclothing with some chemical which will drive the lice out without being irritating or poisonous to the skin.

Captain Hastings suggests the following articles to be carried by every soldier: Clean handkerchiefs, safety pins, stout string, a small roll of adhesive plaster, rhubarb pills, a bottle of five-grain tablets of aspirin, and a small tin box of equal parts of boric acid and starch. This powder is to be employed for the feet and crutch.

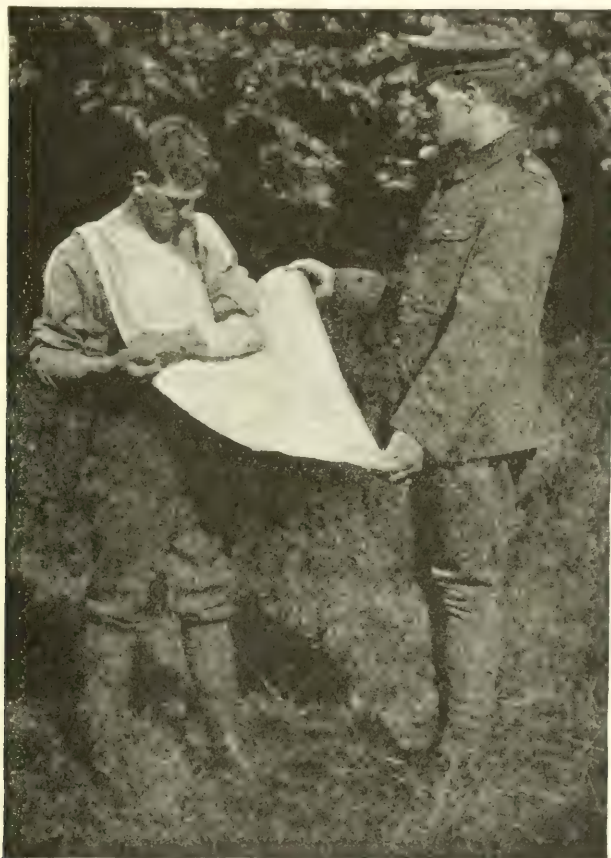


FIG. 27.—Large handkerchief sling—first stage. (Hastings, *First Aid for the Trenches*.)

Transportation. Archibald and McLean,¹ from their eighteen months' service in France, describe transportation as follows: The wounded soldier is carried, usually without delay, by the battalion stretcher-bearers through a communicating trench to the regimental dugout station about 500 yards. Here he receives first aid. Then there is another 500 yards by stretcher-bearers to the horse ambulance. This 1000 yards' journey through a muddy, slippery, uneven trench is often

¹ *Annals of Surgery*, 1917, lxvi, 280.

rough. The horse ambulance carries the wounded back a mile or two to the motor ambulance. Due to the condition of the roads behind the firing line this is pretty bumpy. The motor ambulance transports him to one of the dressing stations, or directly to the casualty clearing station. (See description and diagrams in my review of Colonel Goodwin's book.) The motor ambulance transport may be rough, and in some cases there may be still another transfer to a railroad train.



FIG. 28.—Large handkerchief sling, complete. (Hastings, *First Aid for the Trenches*.)

Surgery of the Advance. Having reviewed Colonel Goodwin's book, there seems little left to say in regard to this problem, but, as Goodwin admits, there are many unsolved questions and plenty of room for improvement. In a very careful study of the literature, I failed to find many reports of what goes on in the regimental aid posts where the primary dressing is applied and the first fixation put on. I have looked upon this as a silent zone. However, in a few contributions sifting through to me in personal letters from France, I have gotten the following impressions:

All authorities seem to agree that a well-equipped hospital, possibly



FIG. 29.—The sleeve sling. (Hastings, First Aid for the Trenches.)



FIG. 30.—The overcoat sling. (Hastings, First Aid for the Trenches.)

mobile (for example, the automobile ambulance hospital which I described last year; the French have a number of these, and Flint, Professor of Surgery in Yale, is the first to organize one for the United States) should be placed as near the firing line as possible. To these



FIG. 31.—Rifle splint for fracture of lower limb. (Hastings, *First Aid for the Trenches*.)

hospitals would be sent, by rapid transportation, the most severely wounded and those in shock.

Up to the present time, nothing has been expected of the ordinary first-aid dressing. It simply covers the wound and prevents secondary



FIG. 32.—A broken leg treated by two pieces of ration box. (Hastings, *First Aid for the Trenches*.)

infection. The results hoped for in the beginning of the war from iodine and other disinfecting agents have apparently been disappointing. In the primary dressing there is no time and no environment for more than the injection of the deep wound through its external orifice with a disin-

fectant, but, so far as I could learn, all the many attempts have been failures. It would be ideal if we could inject some fluid or paste which would temporarily embalm the contents and surfaces of the wound. Connell, of New York, in a personal communication to me is strongly of the opinion that this is possible and he is now investigating along these lines.



FIG. 33.—Treatment of a broken lower jaw-bone by two pieces of bandage.
(Hastings, *First Aid for the Trenches*.)

If he succeeds in his endeavor, the primary infection of the wound can be held temporarily in check until the wounded soldier reaches a hospital where the proper procedure of free incisions under an anesthetic is possible. Other authorities are of the opinion that this primary embalming of the wound is impossible.

The primary fixation of wounds of the extremities is possible at the front, and in many instances is accomplished with the greatest success. The regimental surgeons need special training in the application of the simpler splints, and should be amply provided with these splints.

The most difficult problem is transportation. In my remarks on shock, I brought this out. In the first place it is almost impossible to keep the wounded warm in winter, and, in spite of the best fixation, the roads are so rough that it seems impossible to make the transport painless. Everyone comments upon this. So far as I know, there is no provision for the heating of ambulances, or the treatment of shock during transportation. Even in summer, shocked patients need artificial heat.



FIG. 34.—The human crutch, ordinary position. (Hastings, *First Aid for the Trenches*.)

The methods of transportation are well described by Colonel Goodwin in a general way, and more in detail by Archibald and McLean and by Porter.¹ Between the regimental aid post and the first equipped hospital there are not only different forms of transportation which require changing of the wounded from one to the other, but different dressing stations. Apparently, the object of these dressing stations is to do what

¹ Loc. cit.

was not done at the regimental aid post or to do it better. The majority of authorities are of the opinion that redressing should be reduced to a minimum. That is, the patient should be transported from the first station to a well-equipped hospital as rapidly as possible. Up to the present time it seems to be impossible to accomplish this with the great majority of wounded in action.



FIG. 35.—The human crutch, complete support. (Hastings, First Aid for the Trenches.)

One will find a good description of the first dressing station behind the Austrian Army by Lieutenant-Colonel J. H. Ford¹ and a short note on the method in the battle of the Somme in a letter² from London.

Proust³ is strongly of the opinion that the intermediate dressing stations in the so-called surgical ambulance are not only unnecessary, but harmful. There seems to be, however, a considerable difference of

¹ Military Surgeon, August, 1917, xli, 179.

² Journal of the American Medical Association, 1916, lxxvii, 1313.

³ Bull. et mém. de Soc. de Chir. de Paris, 1917, xliii, 84; reviewed in Surg., Gynec. and Obstet., 1917, xxv, Abstr. 258.

opinion as to what should be done in the various rest or dressing stations in the so-called ambulance service between the regimental post and the first well-equipped hospital which in the British scheme is called the casualty clearing station. Fiolle et Fiolle¹ seems to be in favor of moving the operation station forward, even within the zone of fire, while Albert Martin² argues against this.



FIG. 36.—Carrying wounded in the arms. (Hastings, *First Aid for the Trenches*.)

J. Lalesque,³ from his experience in the ambulance at Verdun, did not transport his severely wounded farther back, but kept them at the advanced station, treated their shock and later operated on them with success, even for abdominal wounds. His primary disinfection was with balsam of Peru.

R. Pique⁴ also favors an advanced operating post, even up to the first-aid station, for the treatment of wounded who cannot endure transpor-

¹ *Rev. de Chir.*, 1916, xxxv, 302.

² *Ibid.*, 1916, xxxv, 235.

³ Review in *Journal of the American Medical Association*, 1917, lxxviii, 1586.

⁴ *Surgery, Gynecology and Obstetrics*, 1917, xxv, Abstr. 148.

tation. This advanced point should be a post reached by stretcher-bearers farther forward than either horse or motor ambulance can reach. He is of the opinion that this group of cases will die if they are transported, and some of them may be saved by keeping and treating them there. He reports such cases.



FIG. 37.—Carrying wounded pick-a-back. (Hastings, *First Aid for the Trenches*.)

Oppel,¹ a Russian surgeon, pleads for bringing competent surgeons nearer the firing line so that emergency operations which must be done there can be done by the most skilled surgeons. He says in this group little is to be hoped for after transportation and later surgical treatment.

Bowlby and Wallace² are of the opinion that motor transport to the casualty clearing station is the keystone to the system, because only in this first, well-equipped hospital can the indicated surgery be done. The same skilled surgeon in the environment of advanced stations cannot accomplish the same result.

¹ Review in *Journal of the American Medical Association*, 1917, lxviii, 1073.

² *British Medical Journal*, 1917, i, 721; review in *Journal of the American Medical Association*, 1917, lxix, 153.

Apparently, Makins¹ is of the same opinion.

It is to be recollected that, in the beginning of the war, the casualty clearing station was equipped chiefly for receiving and evacuating the

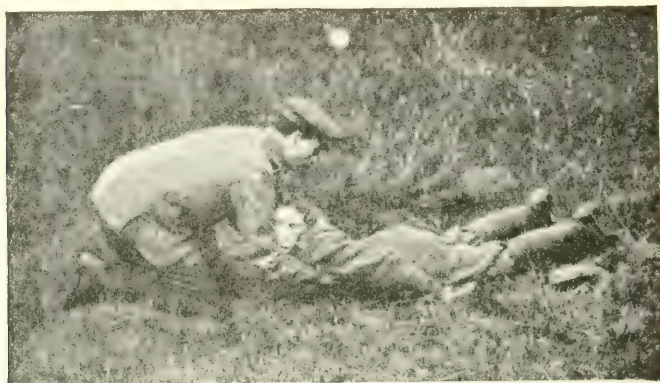


FIG. 38.—Fireman's lift, first position. (Hastings, *First Aid for the Trenches*.)

wounded to the base hospital. Apparently, it is rapidly becoming the chief operative hospital in the zone of advance.

A. Chalier² advocates the operation in one of the advanced dressing stations.



FIG. 39.—Fireman's lift, second position. (Hastings, *First Aid for the Trenches*.)

Cheyron³ agrees with Carrel that the wound can be embalmed at the primary dressing. He employs Mencièr's iodoform-Peruvian-balsam spray.

¹ *British Medical Journal*, 1917, i, 789; review in *Journal of the American Medical Association*, 1917, lxi, 242.

² *Progrès méd.*, 1917, xxxii, 179; review in *Journal of the American Medical Association*, 1917, lxi, 320.

³ Review in *Journal of the American Medical Association*, 1917, lxi, 73.



FIG. 40.—Fireman's lift, third position. (Hastings, First Aid for the Trenches.)



FIG. 41.—Fireman's lift, fourth position. (Hastings, First Aid for the Trenches.)

Vincent¹ also favors primary disinfection. He employs a powder—10 parts calcium hypochlorite and 90 parts boric acid. It is sprayed into the wound and covers the external wound thickly. It should not be used in wounds of the thorax and abdomen. It is to be remembered that Watson-Cheyne injected the wounds with a bismuth paste containing some carbolic. Colonel Goodwin informed me that it was not successful.



FIG. 42.—Fireman's lift, complete. (Hastings, *First Aid for the Trenches*.)

In the beginning of the war, both English and French surgeons attempted to disinfect the wound at the primary dressing. The French as a rule used iodine, the British carbolic acid. Every antiseptic seems to have been tried. So far as I can make out, the men who still favor this method are in the advanced zone and do not see their cases again, while the surgeons farther back, who have an opportunity to observe

¹ Bull. de l'acad. de méd., January 30, 1917, lxxviii, 136; review in *Journal of the American Medical Association*, 1917, lxviii, 1009.

the results of this treatment, are of the opinion that it is ineffectual. The consensus of opinion seems to be that to really disinfect a wound it must be thoroughly opened, cleansed of its contents, and the devitalized tissues excised. As Depage has shown, the sooner this is done after the wound is inflicted, the less necessary becomes the antiseptic; and the later it is done, the more necessary the antiseptic, but the less its effect. Carrel has also demonstrated that, with his method, the fresher the wound the quicker the disinfection, the older the wound the longer

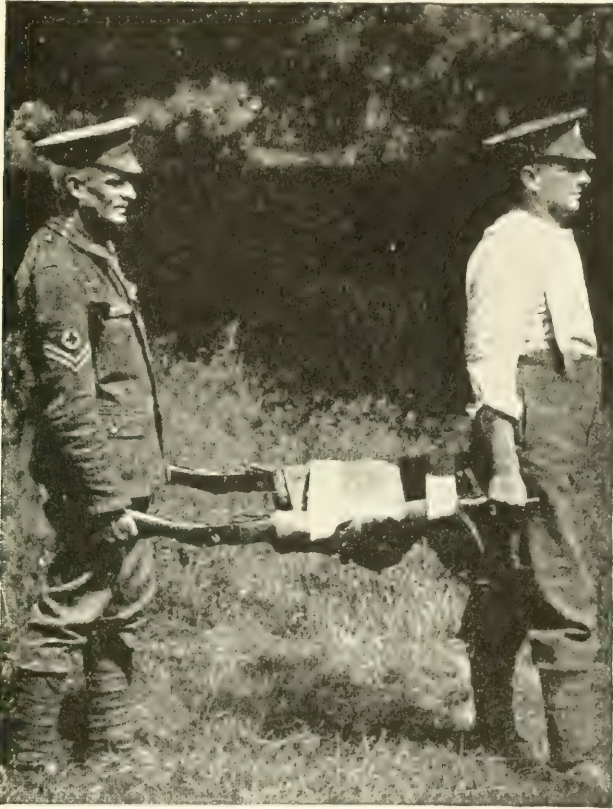


FIG. 43.—The temporary trench stretcher prepared. (Hastings, First Aid for the Trenches.)

the period of treatment, and when the wound is first seen in the phlegmonous stage of acute inflammation, except of the gas-gangrene type, little can be accomplished by incisions and disinfection.

Unfortunately, the whole history of the employment of drugs in medicine and surgery has demonstrated the great inaccuracy of the ordinary clinical observer, and in this war history repeats itself. We have to be skeptical of all claims; nevertheless, the impossible is sometimes accomplished. Bull has found the toxin for the gas bacillus, which all other bacteriologists failed to find, and has also apparently discovered the

antitoxin. Carrel seems to have developed a scientific and precise treatment for infected wounds in which clinical observation is checked by bacteriological examination, and the final test is an aseptic wound which can be closed.

From this we may hope that some protective or curative serum, or some chemotherapeutic agent, will yet be discovered which can be applied in the primary dressing. At the present time it seems impossible in the majority of cases, to create in the regimental aid post an environment which will permit surgical intervention and the beginning of the Carrel method of sterilization of the wound.

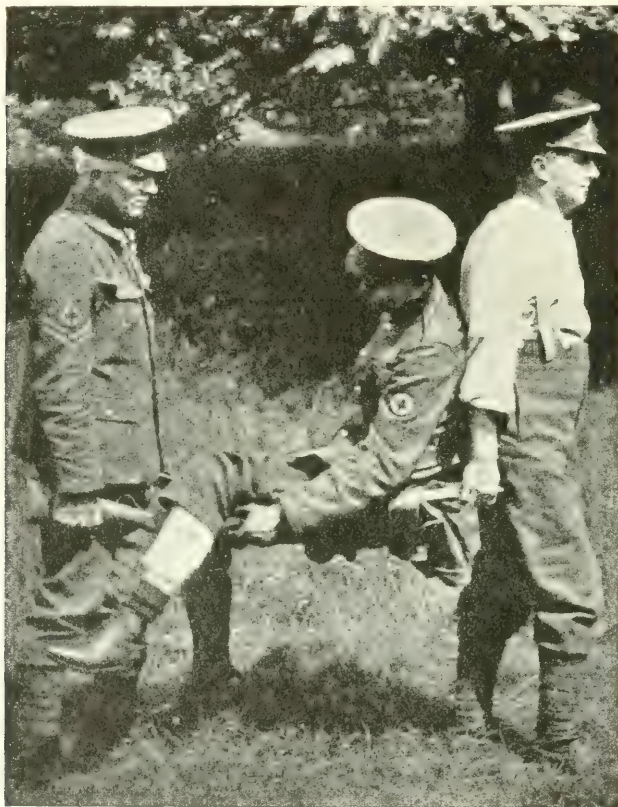


FIG. 44.—The temporary trench stretcher loaded. (Hastings, First Aid for the Trenches.)

Wound Treatment. CARREL'S WOUND TREATMENT. The so-called Carrel-Dakin treatment of infected wounds has excited more interest than any other new method devised from the experience in the treatment of wounds in this war.

One should read the book just published, written by Carrel and Dehelly (Paul B. Hoeber, 67 East 59th St., New York, 1917). The more carefully one reads the book, the more one becomes impressed that it is a great contribution.

The principles underlying the method and its details cannot be grasped in a moment, although the principles are not new, nor the details of the treatment too complicated, if it can be proved that the results justify the more difficult procedure. It is fortunate that the French government has allowed Carrel to return to this country and that the Surgeon-General of our army has accepted the offer of the Rockefeller Institute.

There has been built on the ground of this Institute a complete hospital for the treatment of wounds by the Carrel-Dakin method,



FIG. 45.—The fore-and-aft carry. (Hastings, *First Aid for the Trenches*.)

and there has been established in this hospital a postgraduate school. Groups of officers from the Medical Reserve Corps will attend this school and receive intensive training in all the details of the method. The probabilities are that chief surgeons, or one of their assistant surgeons, assigned to the division hospitals of the cantonment camps throughout the country, will attend this course, and then establish in his division hospital a secondary school of instruction.

Whether the Carrel-Dakin method ultimately wins out as the best



FIG. 46.—The two-hand seat. (Hastings, First Aid for the Trenches.)



FIG. 47.—The four-hand seat. (Hastings, First Aid for the Trenches.)



FIG. 48.—The rifle seat prepared. (Hastings, First Aid for the Trenches.)



FIG. 49.—The rifle seat in use. (Hastings, First Aid for the Trenches.)

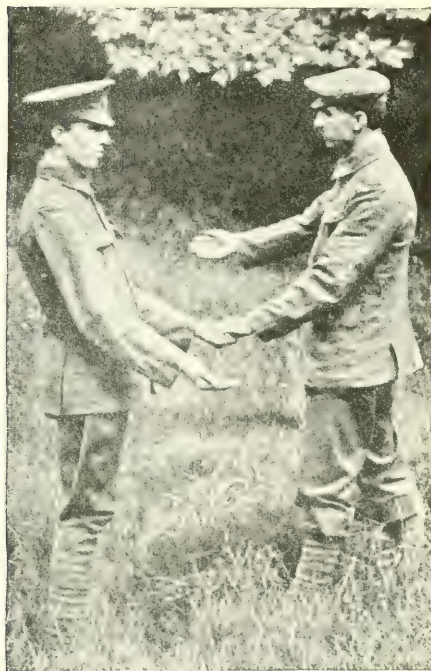


FIG. 50.—The human stretcher, unloaded. (Hastings, First Aid for the Trenches.)



FIG. 51.—The human stretcher, loaded. (Hastings, First Aid for the Trenches.)

method, I feel confident, from my reading of the book and the literature, from my inspection of the experimental war hospital, and from my conversations with medical officers who have taken the course, that the instruction received there is practically essential for the majority of American surgeons, and will be of inestimable value in the treatment of infected wounds in this war.

The majority of American surgeons have had little experience with infected wounds. Our operative wounds seldom suppurate. When we operate for infections, simple methods of drainage usually suffice. Even the wounds in industrial accidents are rarely of the character of shell wounds in this war, and simpler and more crude methods seem to give satisfactory results.



FIG. 52.—Carrying an injured patient by means of his clothing. Preparing to lift (one bearer is missing). (Hastings, *First Aid for the Trenches*.)

The average young American surgeon has, as a rule, given little attention to the problem of an infected wound, chiefly because he is rarely stimulated by actual cases to give this subject much thought.

As I¹ wrote in a paper before the American Surgical Association in 1915, surgical bacteriology has become a lost art. The average surgeon today pays little attention to bacteriology.

In view of the fact that the majority of surgery is aseptic, surgeons have not retained the art of drainage, known to the older generation. The principles of asepsis have been substituted for antisepsis.

Carrel and Dakin have revived the interest in surgical bacteriology,

¹ PROGRESSIVE MEDICINE, December, 1916, p. 272; *Surgery, Gynecology and Obstetrics*, 1916, xxiii, 182.

have experimented anew with chemotherapeutic agents used in anti-septic surgery, and have improved the methods of drainage.

No one anticipated the huge wounds and the infection that were encountered in this war. Preventive medicine apparently was prepared, and the diminution in communicable infectious diseases and preventable diseases has demonstrated that the great development in preventive medicine was in reality a preparation for war on a world-wide scale. Unfortunately, surgery was not prepared, except in the skill, ingenuity and great number of well-trained surgeons. It is fortunate that we have the material capable of being trained in the newer methods, and it seems as if Carrel and Dakin had formulated the method in which all of us should be trained.

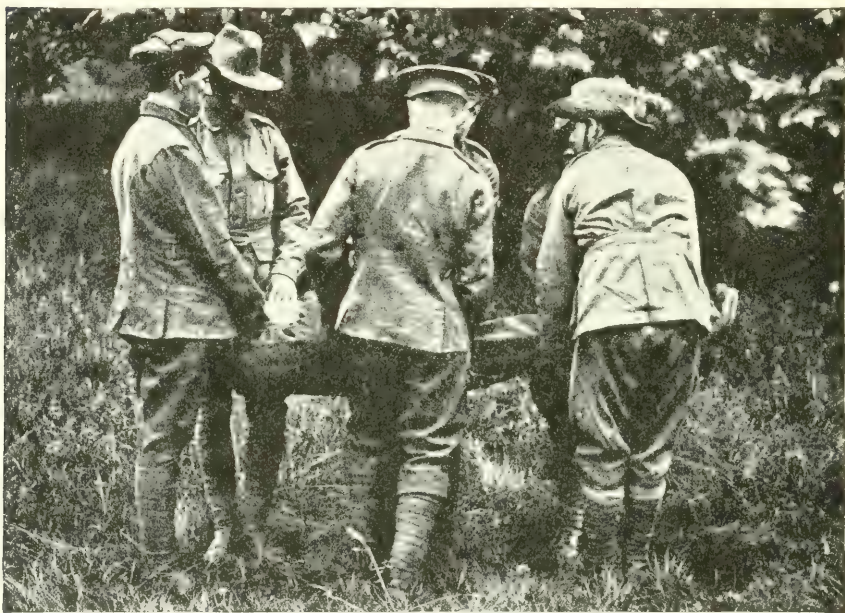


FIG. 53.—Carrying an injured patient by means of his clothing. Moving off. (Hastings, *First Aid for the Trenches*.)

The great dangers in these huge infected wounds are the primary mortality from infection, the increased number of necessary amputations for infection, and not for tissue destruction; the prolonged healing of a suppurating wound which leads to numerous complications, and the greater number of permanent disabilities.

The evidence seems to show that if the Carrel-Dakin method can be instituted at the proper time and carried out in all its details, there will be a lower mortality, a great reduction in the number of amputations and that the large wounds will be closed at an earlier period. For this reason the number and character of permanent disabilities will be tremendously reduced.

If this proves to be correct, this method of treating infected wounds

in war will tremendously reduce human suffering, it will reduce the cost of the war, both during the periods of activity and for years afterward, and during the war will decrease the wastage of men and therefore increase the fighting efficiency of the armies.

In attempting to establish a method for the treatment of infected wounds, we must throw aside petty jealousies, avoid travelling along lines of least resistance, be willing to go through the mental labor of mastering a more complicated scheme, and be willing to undertake a method which will throw a greater burden upon the medical personnel, provided that results justify this increased effort.

At the present time many experienced surgeons are of the view that the Carrel-Dakin method of treatment is too complicated, and that



FIG. 54.—The blanket stretcher. Unrolling beneath patient. (Hastings, *First Aid for the Trenches*.)

simpler methods can be devised to accomplish the same results. But I am unable to find the evidence to substantiate any of these statements.

We may grant for the moment, although it is not proved, that other methods will make the same reductions in mortality and the number of amputations, but this leaves the most important results to be ascertained.

The earlier closure of the wound apparently is an essential feature in war surgery from every stand-point.

The sooner the wound is closed, the less becomes the seriousness of the complications. Prolonged suppuration has more to do with destruction of tissue function than the primary injury.

Suppuration under control and the wound closed allow an earlier

treatment of the bone lesion, nerve, tendon, muscle and joint complications. The entire orthopedic problem becomes simpler when infection is successfully and quickly combated. Reconstruction and reëducation can be begun earlier.

The shorter period of an open drained wound gets the patient out of bed and out of the hospital and relieves congestion in the hospitals near the front.

I am confident that if the results of the Carrel-Dakin method are to be in the hands of all as they have been in Carrel's, there is no question that too much time and energy cannot be employed in the instruction of surgeons in the method, and any amount of time and energy will really represent an economy in carrying out the method in all its details.



FIG. 55.—The blanket stretcher. Rolling blanket round rifles. (Hastings, First Aid for the Trenches.)

The Carrel-Dakin method gives its best results when it is carried out in a properly organized and equipped hospital. This does not mean buildings, but trained personnel and equipment.

The method begins with an operation performed under local or general anesthesia. At this operation the wound is opened, so that every recess can be inspected and palpated. Foreign bodies are removed, fragments of bone are cleansed and replaced; devitalized tissue is trimmed; all bleeding-points are ligated with chromic catgut (silk is contra-indicated).

Then the rubber tubes of proper size and shape are introduced in such a way that the solution will come in contact with the entire surface of the wound.

These rubber tubes must be properly adjusted to glass tubes, and the glass tubes to a single larger tube communicating with an irrigating bath. The limb must be properly fixed so that the fracture, if there be one, is maintained in good position, and this fixation dressing must allow easy access to the wound.

Each bed must be provided with an overhead frame to carry the irrigating bath and the necessary extension apparatus.



FIG. 56.—The blanket stretcher. Moving off. (Hastings, First Aid for the Trenches.)

The nursing personnel must be trained in the two-hourly application of the Dakin fluid, and the proper supervision of the dressing and splint apparatus.

Each surgical unit must have at least one individual trained in the preparation of the Dakin fluid, and a bacteriologist trained in the methods of estimating the bacterial count.

The surgeons need special training in the primary operation, especially in relation to preserving fragments of bone and the application of the drainage tubes, in the fixation of the splints, and in the various over-

head extension methods. All the surgical personnel must understand the methods of redressing, so that the danger of secondary infection is reduced to a minimum. They must also have special training in estimating whether the tubes are working properly, how they can be readjusted with the least discomfort to the patient and the least danger to the wound. The surgeon must be able to supervise all the apparatus of splinting and extension, and the minute technic of the constant flooding of every recess. The surgeon must be able to interpret the bacterial count, to supervise that the smears are made from the most inaccessible cavities, and must be able to judge when it is safe to close the wound.

So far as anesthesia is concerned, and so far as making the incision goes, the majority of our surgeons need no special training. But I get the impression that the trimming of devitalized tissue and the thorough and complete hemostasis will be quite different from the usual peace operation. I also get the impression from Carrel that fine chromic catgut is a safer ligature than silk. He seems to be of the opinion that the Dakin fluid will be more likely to affect the silk than the chromic catgut.

We all know that the best treatment of secondary hemorrhage is prevention.

The majority of our surgeons need special training in the application of the proper splints and in the technic of the various methods of extension.

In peace surgery few have experience with the fixation of an extremity in which there is an open wound. This is a much more difficult matter than when the wound is closed.

The majority of our surgeons know nothing about bacteriology, or the interpretation of the bacterial count in a smear under the microscope, or the result of the culture study.

In my experience with teaching, I have found it easier to instruct my interns to resect the stomach, remove gall-bladders, take out prostates, perform decompression of the skull, than to properly treat an infected wound of the hand or of the knee-joint.

The average young surgeon today is at ease when he explores a clean abdomen, but at sea when he meets a localized infection, or a general peritonitis. It is difficult to teach them when to drain in border-line cases of appendicitis, or in perforated gastric ulcer. It is difficult to teach them when to do enterostomy in perforating wounds of the intestine and intestinal obstruction.

Surgeons who go to war today must turn their attention to surgical bacteriology, to all the past knowledge of wound infection, to the methods of drainage, to hemostasis that will guard against secondary hemorrhage, to fixation splints which will allow the dressing of the wound, and unusual methods of extension rarely employed in peace surgery.

In peace surgery the surgeon's work is, as a rule, finished on the operating table. The wound after this needs little attention. The intern is chiefly concerned with treating postoperative gas distention and washing out the stomach. The ward work has less to do with the

wound and more to do with the individual. In war surgery the treatment begins with the operation, and constant hourly supervision does not end until the infection is controlled and the wound closed.

The operative problems in relation to bone, muscle, tendons, joints, are not at all difficult, nor much different from those in times of peace. The great problem is the combating of infection and accomplishing the early closure of the huge wound.

This is why the Carrel school at the Rockefeller Institute is essential as the beginning of the American great postgraduate study of wound infection. It is possible, and there is time, to train a sufficient number of surgeons now, so that when our armies reach the firing line, not only our hospitals, but our surgeons will be prepared for the better treatment of wound infections. At the present time the preparation of our hospitals is far ahead of the preparation of our surgeons.

The instrumentarium necessary for the Carrel-Dakin treatment of wounds will not be at all difficult to obtain if this method is adopted at once, and schools are established in all the division and base hospitals in this country. Then, if the hospitals of the great industries adopt this method, there will be such a demand that all the various things can be made wholesale. At the present time, when the demand is comparatively small, the manufacturers, busy with other urgent calls, are not interested in making a few rubber and glass tubes and the other small, but essential, appliances.

I trust before this is published, that the demand for the Carrel-Dakin apparatus will have become so great in this country that the supply will be sufficient for all the needs when our war activities begin.

Major H. P. Cole, assigned as chief surgeon to the division hospital at Macon, Georgia, has just finished his course at the Rockefeller Institute, and has been given authority by the Surgeon-General to establish in his hospital the perfected Carrel-Dakin method. I trust to be able to add to this article Major Cole's report.

I fear that some of my surgical colleagues in this country who do not take the same view of the Carrel method or who are attempting to simplify it and devise a substitute, may create a dilemma and obstruct the early acceptance of the Carrel method by the Surgeon-General's Office, and interfere with its universal introduction into the military and civil hospitals of this country. At the present time I know of no substitute, and it seems to be the wiser procedure to immediately adopt the Carrel method, introduce it into all our hospitals in all its details, create a demand, so that the manufacturers can produce the necessary adjuncts in sufficient quantities and at less cost, and what is just as essential, more surgeons should immediately learn the method.

Sherman, of Pittsburgh, and Nolan, of Birmingham, well-trained industrial surgeons are doing their part to get this method introduced in all the large hospitals connected with the great industries of this country.

Principles. Carrel's remarks should be read in the original. However, it should be forcibly stated that this method rests upon a most painstaking and long experimental research with many antiseptics.

Bacteria of various types vary in their number and virulence in different localities. Apparently, in France, the number and virulence of the bacteria in the soil is unusual. The clothes and skin of the soldier become saturated with dirt containing organisms. In trench warfare it seems impossible to arrange for daily bathing and daily cleansing of the underclothing. The explosives employed carry pieces of clothing and skin into the wound. The subcutaneous wound is usually large, ragged, and filled with devitalized tissue and blood. The external wound, or wounds, may be small. This wound is entirely different from the compound fracture treated by Lister. Here, as a rule, the external wound was produced by the bone from within. Lister accomplished wonderful results by the simple application of a piece of lint saturated with carbolic acid over the external wound. There is no evidence that this carbolic acid permeated the wound of the compound fracture and disinfected it. Although Lister attributed his wonderful success to such disinfection and to the prevention of the entrance of air, there is every reason to conclude that his result was due to non-interference, that is, to not probing the wound with a dirty finger or instrument, and the protection of the open wound with an antiseptic covering from secondary infection.

We have long known, from the splendid experimental work of Colonel La Garde, of our Army, that a bullet passing through the air is not disinfected. However, the ordinary bullet does not carry many organisms, and a wound from such a bullet is less apt to be impregnated with foreign bodies, clothes or skin.

In past wars, before the development of bacteriology and asepsis, apparently the chief cause of suppuration in gunshot wounds was not a primary infection, but a secondary one. I have reviewed this in previous numbers of *PROGRESSIVE MEDICINE*.

In 1870, it was the rule of all military surgeons to probe the wound with the unclean finger. From the experience of this war, there developed the principle of non-interference and immediate covering of the wound with a piece of sterile or antiseptic gauze. Secondary infection was eliminated to a large extent, and the majority of such bullet wounds healed *per primam*. True, there were cases of suppuration, and the majority of these, as brought out by von Reyher in the Russo-Japanese war, were due to primary infection of a character and virulence beyond the power of the tissues to take care of.

In this war the character of the wound is such that one cannot expect the tissue to combat the bacterial infection.

In the first hours after the injury, the bacteria are mixed with the blood, and devitalized tissue, and remain on the surface of the wound. The rapidity of their multiplication depends upon more than one factor. This is especially shown in gas-bacillus infection, which may be very rapid or delayed.

The disinfection of these huge infected wounds is less difficult within the first twelve hours, but, unfortunately, during this time it is almost impossible to transport the wounded man to an environment where the necessary operation can be performed.

There seems to be no disagreement as to the first method of pro-

cedure—the wound must be opened, the foreign bodies removed, the devitalized tissue excised, detached particles of bone cleansed and replaced, drainage instituted.

The difference of opinion begins with the method of drainage, the antiseptic, if any, to be employed, and the methods of after-treatment.

The majority of authorities prefer rubber drainage tubes to gauze. Apparently most surgeons have now discarded Wright's method of lymph lavage encouraged by irrigation with salt solution.

The single disinfection of the entire wound with iodine, pure carbolic, alcohol or ether has proved disappointing. Carrel and Dakin, after experimenting with many antiseptics, finally selected Dakin's solution, the efficacy of which rests upon chlorine in a strength sufficient to be antiseptic, but not strong enough either to destroy the tissues of the wound, or irritate the surrounding skin. This antiseptic must be employed continuously until the secretions of the wound are free of bacteria. Apparently this antiseptic is not devitalizing to the vascular tissue of the fresh wound, nor inhibitory to the new reactive granulation tissue.

The chief cause of destructive processes in a wound are the bacteria themselves. In selecting an antiseptic to combat them, one must be chosen which is not harmful to the tissues, nor toxic by absorption, nor inhibitory to the normal healing processes.

We cannot expect of an antiseptic more than that it will destroy the bacteria on the surface of a wound and in the secretions. We cannot expect it to penetrate deeply. When bacteria penetrate beyond the surface of a wound, we must depend upon the general conditions of the patient and the local activities of the granulation tissue. Of course, when abscesses develop, they can be opened. The development of an abscess is a sign of good general and local resistance. Diffuse phlegmons can be excised and drained.

Fortunately, in the majority of cases of wounds of this character, the bacteria are chiefly on the surface and in the secretions. The principle of the technic rests upon opening the wound and placing the drainage tubes in such a manner that the antiseptic fluid constantly bathes the entire surface and the most remote recesses and corners. This antiseptic must be continuously replaced because its power is but of short duration.

Carrel, by his methods, seems to have accomplished these requirements. Apparently, it is easier to grasp the principles of the method than to learn in practice the details of the management.

Dakin's Solution. It seems unnecessary here to describe this in detail. The chief complaint is that this antiseptic solution requires an expert to make it, and that it is very unstable. Many are trying to find a substitute. Of course, the various manufacturers of chemicals are attempting to make an ampoule or a tablet which can be dropped in a certain quantity of water and thus simplify the making of the solution.

So far as I know, no such substitute has been obtained, although there are claims for a number of them.

When it comes to the preparation of Dakin's fluid in any of our large

civil hospitals or in any of the military hospitals here or abroad, there should be no difficulty. Someone can be found among the drafted men with sufficient knowledge of chemistry to prepare this solution properly. The materials can easily be supplied in bulk. The only difficult

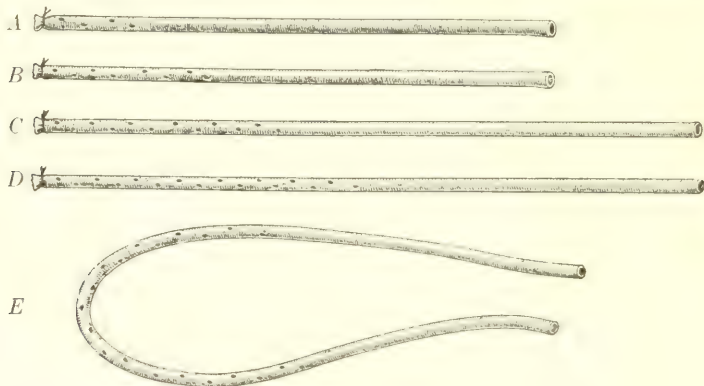


FIG. 57.—Conducting or “instillation” tubes, rubber, with multiple holes, closed at one end. *A*, tube 30 cm. long, pierced over a length of 5 cm.; *B*, tube 30 cm. long, pierced over a length of 10 cm.; *C*, tube 40 cm. long, pierced over a length of 15 cm.; *D*, tube 40 cm. long, pierced over a length of 20 cm.; *E*, tube open at both ends, and pierced over a length of 20 cm. in its median portion (10 cm. = 4 inches). (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

part of the procedure is the titration. It is only necessary to train one or two such individuals for each hospital unit.

Technic. First, there must be the rubber tubes (Fig. 57). These tubes are perforated with an ordinary punch. As a rule the end of

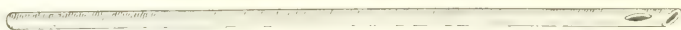


FIG. 58.—Conducting or “instillation” tube with terminal opening. Tube of about 30 cm. long, open at both ends, with a lateral opening near one end. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

the tube is closed with a ligature. The perforations are about eight to each 5 cm., and the hole is about 0.5 mm. ($\frac{1}{30}$ inch). It is important to remember that the perforated part of the rubber tube must not project beyond the wound. In some instances a single tube is



FIG. 59.—Conducting or “instillation” tube covered with a sheath of bath toweling (tissu éponge). (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

employed with a hole in the end and one lateral opening (Fig. 58). When one wishes to apply the Dakin solution to a surface wound, the perforated tube is covered with a sheet of bath toweling (Fig. 59). This encasement is no longer employed for deep wounds. Attached

to the rubber tube are various forms of glass distributing tubes (Fig. 60, *A* to *D*). These vary with the number of drains. Finally, there is a single rubber tube attached to a flask of the ordinary irrigating type

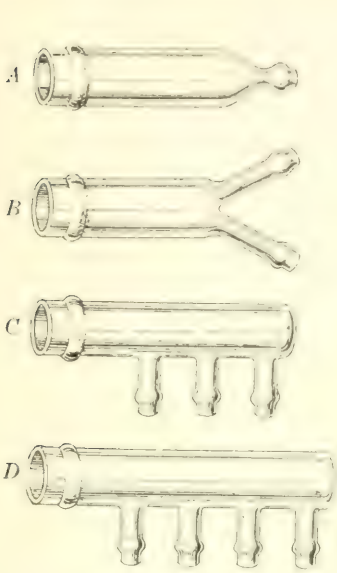


FIG. 60. — Glass-distributing tubes (verre de Gentile). *A*, tube with one branch; *B*, tube with two branches; *C*, tube with three branches; *D*, tube with four branches. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)



FIG. 61.—Nurse using a pinch-cock and so instilling antiseptic liquid. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

(Fig. 61), and a pinch-cock (Fig. 62) which is opened every two hours by the nurse. There is opportunity for some modifications here, that

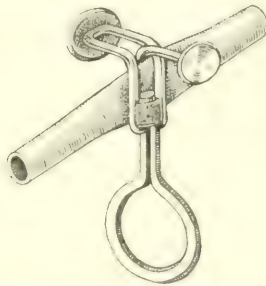


FIG. 62.—Pinch-cock (Pince de Mohr à ressort). (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

is, a method which will allow only a certain amount of fluid to pass beyond the pinch-cock. Then the nurse would need less training. I may be able to report on this before the paper goes to print.

Dr. Carrel is devising an electric clock which will liberate the solution at every bed at a given time. This, of course, will simplify the nursing problem.

The testing of the permeability of a tube is shown in Fig. 63, the syringe employed in Fig. 64, the adjustment of the drop counter in Fig. 65.

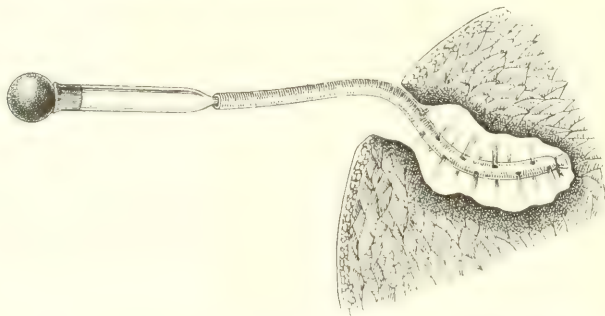


FIG. 63.—Testing the permeability of a conducting tube at the time of dressing. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

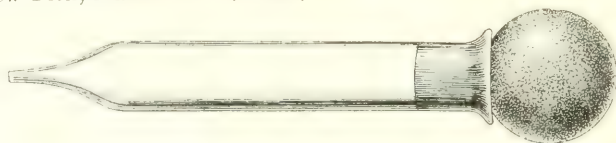


FIG. 64.—Syringe (*Seringue de Gentile*). (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber New York; Masson & Co., Paris.)

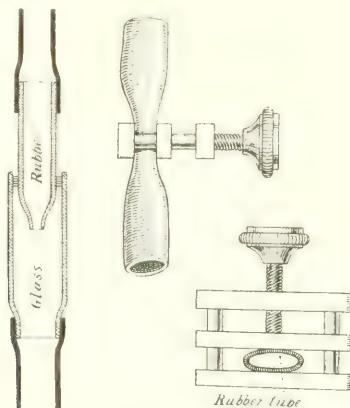


FIG. 65.—“Drop counter,” Gentile’s. Screw pinch-cock (*Pince de Mohr à vis*). (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

The application of the tubes to the various types of wounds is illustrated in Figs. 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77 and 78. At the time of the operation, therefore, the surgeon first has formed an idea of the wound from the x-ray study, and a clearer one after the incisions are made. He should have a large assortment of different lengths of tubes, perforated and not perforated, and a sterilized punch, because

often the perforations will have to be made as the tube is adjusted. Tubes covered with bath towelling can be prepared and sterilized by the nurse. Then there must be various forms of glass connecting tubes.

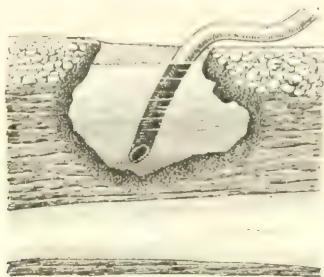


FIG. 66.—Wound with superior opening which can be filled like a cup. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)



FIG. 67.—Surface wound receiving liquid from a tube perforated by small holes. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

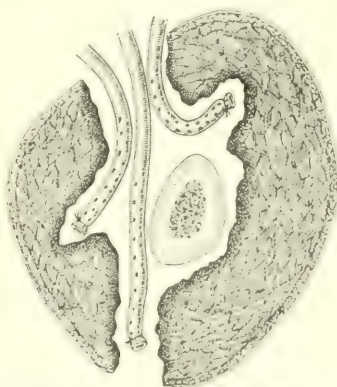


FIG. 68.—Irregular wound with several perforated tubes in its diverticula. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

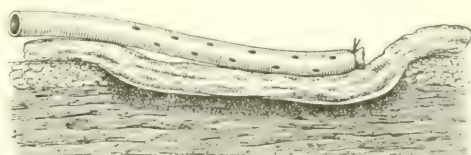


FIG. 69.—Wound with surface horizontal. Wrong method of placing the tube. The perforated instillation tube is on the surface of the compress. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

It requires experience and ingenuity to place these tubes in the wound in such a way that the solution will reach every area of surface. The best time for this is at the operation.

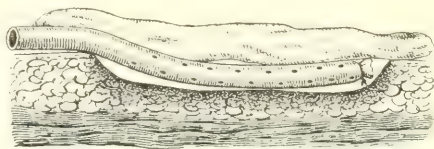


FIG. 70.—Wound with surface horizontal. Right method of placing the tube. Tube in contact with the wound and covered with a gauze compress. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

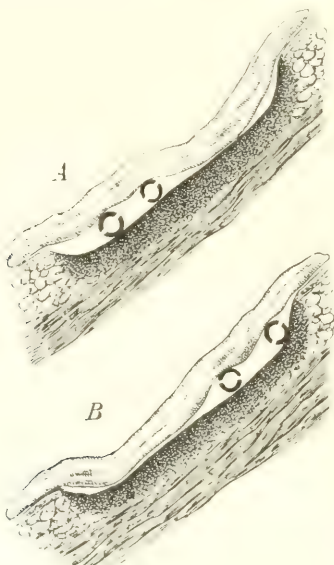


FIG. 71.—Wound with surface inclined. *A*, tubes placed the wrong way, along the lower border of the wound. *B*, tubes placed the right way, along the upper border of the wound. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

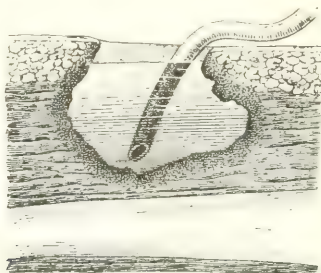


FIG. 72.—Wound with opening superior, so that it can be filled like a cup. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Dressing. First there is applied about the tube compresses soaked in Dakin's solution. Remember the perforated portions must be buried

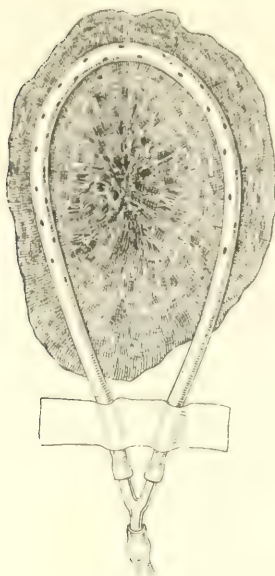


FIG. 73.—Surface wound. The instillation is made by means of a tube perforated in its middle portion, whose ends, fixed to the skin by a strip of adhesive plaster, are joined by a Y-shaped distributor. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

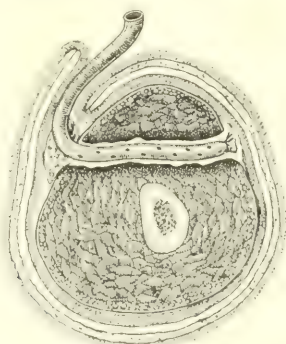


FIG. 74.—"Seton" wound, in the interior of which is placed an instillation tube perforated with small holes and which passes through the dressing at its upper part. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)



FIG. 75.—Compound fracture of tibia with the opening of the wound on the anterior aspect of the limb; in the seat of fracture is a tube open at the end. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

wholly in the wound. The skin is then protected with gauze sterilized in vaseline (Fig. 79). The size of this gauze is 8 by 10 cm. This pro-

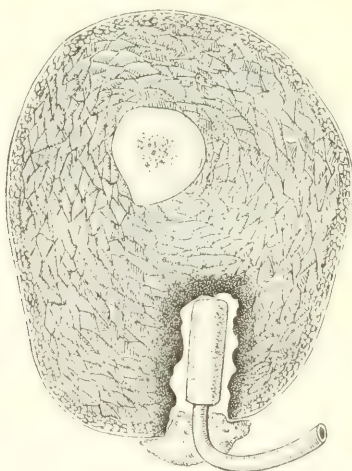


FIG. 76.—Wound of the soft parts whose orifice is at the posterior aspect of the limb. Instillation to the "roof" of the wound by means of a tube sheathed in "bath towelling" (*tissu éponge*). (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

teets the skin. This first layer is covered with sheets of cotton-wool (Fig. 80) made in layers as shown in Fig. 81. These sheets can easily

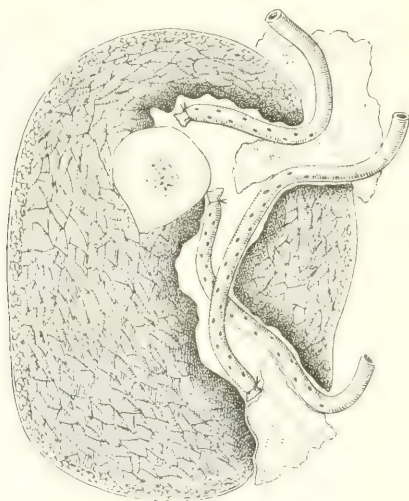


FIG. 77.—Irregular wound of the thigh. Two tubes are placed in the wound anteriorly and one posteriorly. These tubes are applied to the surface of the tissues. They are kept apart by gauze packed between them in the opening of the wound. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

be applied around the limb and fixed with safety pins, as shown in Fig. 82. No roller bandage is required. Water-proof covering should never

be employed. The fixation of the irrigating tube which is attached to the flask is illustrated in Figs. 83, 84 and 85. Such a dressing must be carefully adjusted so the tubes will remain in place.

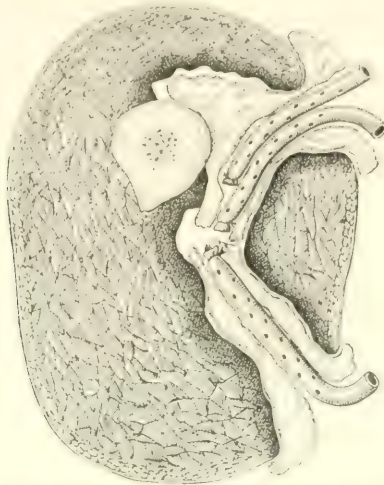


FIG. 78.—The same irregular wound of the thigh. The tubes are wrongly placed. Instead of being in contact with the tissues, they are in contact with the gauze which fills the wound. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Immobilization. This becomes essential when there is a fracture, and the character of the fixation dressing depends upon the fracture. But the preliminary dressing of Carrel, as shown in the illustrations, is one that lends itself to any proper fracture splinting. In many cases

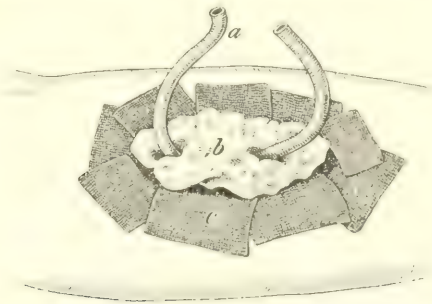


FIG. 79.—Dressing: *a*, conducting tube kept in the wound by gauze placed in the orifice; *b*, squares of gauze sterilized in vaseline placed on the skin around the wound. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

the patient was placed on a Bradford frame. The bedding is protected with a rubber sheet. But if the regulation of the irrigation is proper, there is very little overflow.

The patient is then taken to his bed and the instillation of the anti-septic is begun as shown in Fig. 61. The instillation may be continuous

or intermittent. Carrel stains his Dakin solution a rose tint with permanganate of potassium to prevent mistakes. Although continuous instillation may be better than the intermittent, it is not suited to the

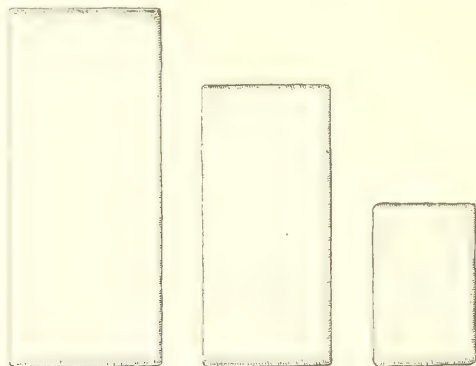


FIG. 80.—Sheets of dressings, composed of layers of absorbent cotton-wool, non-absorbent cotton-wool, and gauze. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

majority of wounds. The intermittent is more practical. The nurse releases the pinch-cock every two hours for a few seconds. The quantity of fluid to be injected varies with the size of the wound. In twenty-



FIG. 81.—Section of the sheet of dressing: *a*, gauze; *b*, carded (non-absorbent) cotton-wool; *c*, absorbent cotton-wool; *d*, gauze. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

four hours the quantity varies from 250 to 1200 c.c. The object is to constantly moisten the wound with liquid without wetting the patient beyond the dressing.

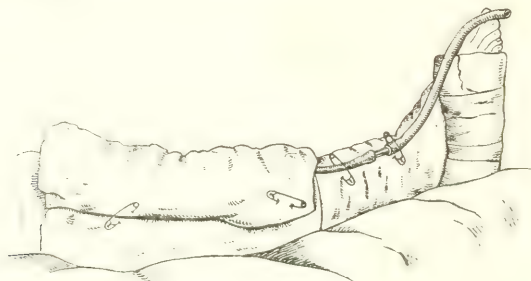


FIG. 82.—Dressing applied around a compound fracture of the leg, and fastened by safety-pins; the distributing tube is fixed to the plaster apparatus by safety-pins. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Carrel does not illustrate or go into the details of the various forms of splints with and without extension. This I will discuss in another part under splints.

Redressing. If there is no discomfort, the external dressing is changed once in twenty-four hours. Bacteriological examinations are made every two or three days. In the ordinary daily redressing the outer

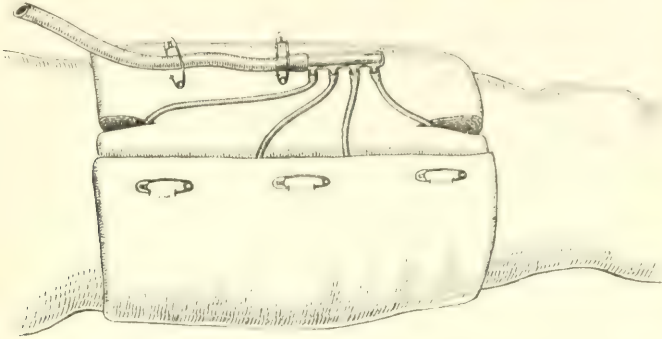


FIG. 83.—Position of the distributing tube on the surface of the dressing. The conducting tubes penetrate the dressing, either at the point where the end of the layer of cotton-wool and gauze overlaps, or through windows cut with scissors. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

gauze only is changed, the positions of the tubes checked, and the same dressing replaced.

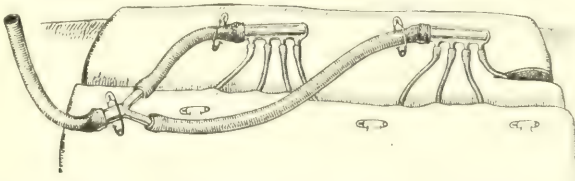


FIG. 84.—Arrangement on the surface of a dressing of a Y-connecting tube and of two distributing tubes with four branches. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Observation. The patient may complain of a little pain when the instillation begins. Complaint later is an indication of some fault in

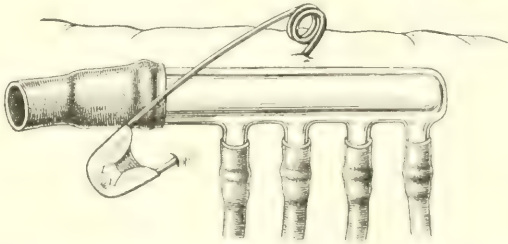


FIG. 85.—Method of fixing a distributing tube to the surface of a dressing. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

the technic—as a rule an instillation with too much pressure, or because the tubes are too tightly gripped by the tissues. This can be readily remedied by decreasing the pressure or opening the wound.

Duration of Treatment. The instillation continues day and night until bacteria disappear from the smears. In wounds of the soft parts this requires from three to ten days; in a compound fracture, fifteen days or more. The earlier the treatment is instituted, the quicker the sterilization. When the treatment begins after the stage of suppuration, the period of instillation will be longer.

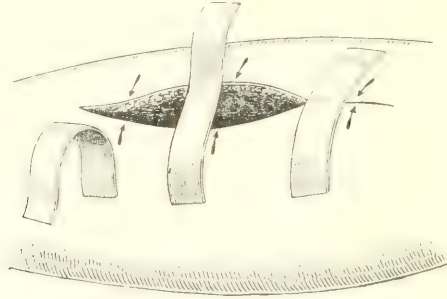


FIG. 86.—Bringing together the lips of a wound by means of strips of adhesive plaster. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Bacteriological Examinations. As the ultimate object of this wound treatment is sterilization and closure of the wound, there must be a careful bacteriological check. In the majority of cases this is done by making smears on slides and counting the bacteria. A chart is kept, and this is one of the most important records. The smears should be taken about two hours after the last instillation.

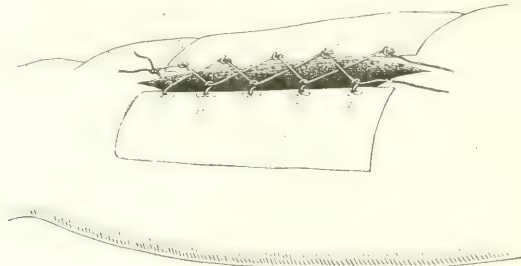


FIG. 87.—Bringing together the lips of a wound by means of elastic traction. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Now and then, especially before the closure of the wound, the tubes must be removed and smears made from the deepest part. Before closing the wound one must be quite certain that every recess is sterilized. At every redressing the most careful technic must be followed to prevent secondary infection.

Closure of the Wound. It is to be recollected that a wound properly treated by the Carrel method secretes no pus, but the absence of the ordinary suppuration is not an indication of sterility, and it is for this reason that there must be a bacteriological check. Sterility must have

been maintained for at least two or three days. In addition the patient must be free from fever, in good general condition, and in the region of the wound there should be no evidence of phlegmon.

The wounds are closed by elastic bands, strapping, or suture (Figs. 86 and 87).



FIG. 88.—Case 577. Wound of knee, fifth day. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Before closing, the skin is shaved and dried. In some cases the wounds are progressively closed. When sutures are employed, the patients are anesthetized. When the wound is closed, muscle, nerve and tendon injuries can be repaired at once. In compound fracture with a gap, bone grafting can be performed after the wound has become sterile, and fat transplantation to fill up the cavity. In some instances Mosetig's or Beck's paste is used to fill the dead space.

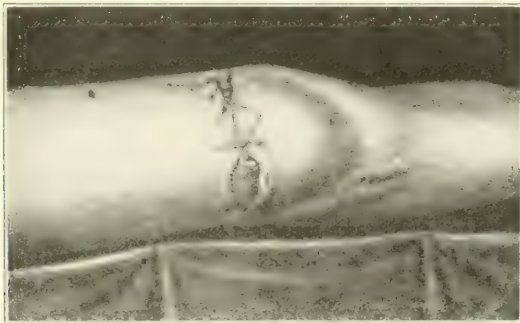


FIG. 89.—Case 465. Suture, seventh day. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

Results. One is impressed that huge, gaping, granulating wounds, with and without fracture, have been successfully closed, as illustrated in Figs. 88, 89, 90 and 91. Even extensive wounds of the joints (Figs. 92 and 93) have been closed.

When to Operate. If the wounded soldier comes into the hospital within the first few hours and before the inflammatory reaction begins, the operation should be performed at once and instillation begun. That is, operation is indicated in all cases in the so-called first stage,

which may be looked upon as pre-inflammatory. This stage, as a rule, lasts from twelve to twenty-four hours. It may be prolonged to forty-eight hours. During this time free incision and extensive search for foreign bodies presents no danger.

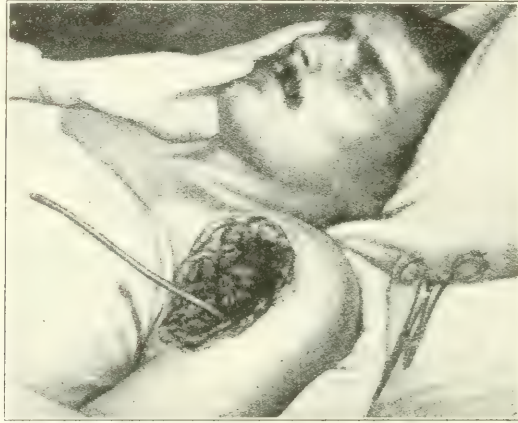


FIG. 90.—Case 433. Fracture of neck of humerus, fifteenth day. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

In the second stage there are local and general signs of an inflammatory reaction. Locally, there are two types—the gas-gangrenous and the phlegmonous. In the former, the early stage of gas gangrene, immediate multiple incisions are indicated, but in the latter—the phlegmonous—Carrel is of the opinion that surgical measures are contra-indicated, because of the danger of septicemia.

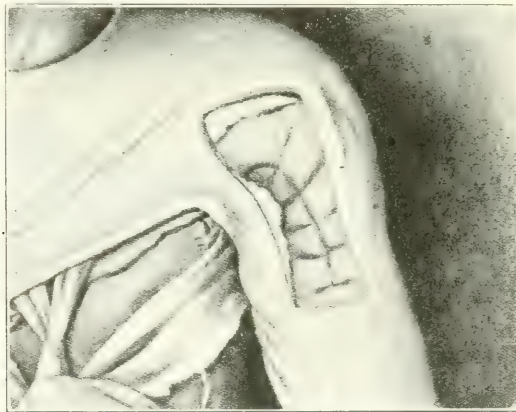


FIG. 91.—Case 433. Suture, seventeenth day. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

He writes: "To operate at this moment is to make the patient run the same risk as a case of acute appendicitis which is operated on after three or four days."

I have had a large experience during twenty-five years with operations for acute appendicitis after the third and fourth day, and I have known of this fear of operation during this stage all this time, but I have never been able to share it, nor have I ever regretted operating at once upon any case of appendicitis, so I cannot agree with Carrel's statement just quoted. In *PROGRESSIVE MEDICINE* beginning in 1899, I have reported my own experience and that recorded in the literature on gas gangrene, confirming the conclusions of Carrel that immediate incisions are indicated.

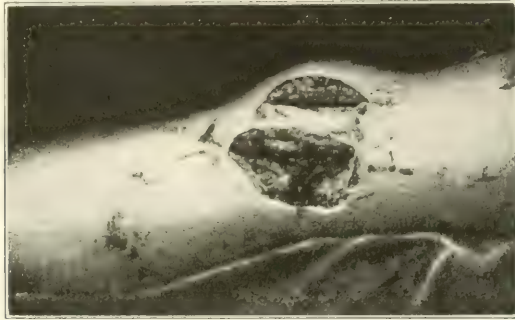


FIG. 92.—Case 594. Shell-wound of knee; partial fracture of condyle, sixth day. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

I have also had considerable experience with the so-called diffuse phlegmonous infections of the extremities, but not in huge gunshot wounds. In the kind which I have observed, I have always practised immediate extensive incisions followed by continuous irrigation or the bath treatment. I have no evidence that this was harmful.



FIG. 93.—Case 594. Wound became sterile the sixteenth day and was closed the twentieth. (Carrel and Dehelly, *The Treatment of Infected Wounds*. Published by Paul B. Hoeber, New York; Masson & Co., Paris.)

It is quite true that the phlegmonous infection is a very grave local condition. Now, if patients recover from this without free incision, this is not evidence that they would not have recovered quicker with incisions, and perhaps some who died without early free incisions, might have recovered if the operation had been performed. I have

read Carrel's book again and again for the evidence on which he bases this statement, but I cannot find it. Perhaps in a phlegmonous inflammation one would not search in the same way for foreign bodies, but surely, the wound could be enlarged, thoroughly exposing the fracture or the joint, and thoroughly opening up the track of the missile.

I trust every surgeon in this country will read again and again this splendid contribution of Carrel and Dehelly on *Infected Wounds*, and I hope that many will have the opportunity of taking a special course with Carrel at the Rockefeller Institute. One who reads this book and then goes through the wards and various departments of the hospital established by Rockefeller, is impressed that Carrel has brought into the surgical treatment of infected wounds a precision that had been sadly lacking in the treatment of such wounds from the beginning of surgery.

When surgeons had many of such wounds to treat, they lacked the knowledge of bacteriology. In surgical practice in the past fifteen to twenty years, there have been relatively so few infected wounds that surgeons have lost interest, and for this reason they were poorly prepared for what is the greatest problem in this war.

Fortunately, I am able to present here a personal communication of Major Herbert P. Cole who has just finished his course of instruction under Carrel at the Rockefeller Institute. So far as I know, Major Cole is one of the first of the new chief surgeons of the base hospitals at the cantonments to receive this instruction.

It is interesting to note here that in a letter from Colonel Munson dated September 24, he informs me that these base hospitals are not only intended for the care of the sick and injured in the camps of instruction, but that they will also be organized as teaching hospitals. Every specialty of medicine and surgery will be represented. Major Cole will establish in his hospital the Carrel method of treatment and will give a course similar to that given in the Rockefeller Institute.

Again we find that the Surgeon-General and his staff are doing more than their part for the training of medical reserve officers for their special work.

The Carrel Course of Instruction in War Surgery at the Rockefeller Institute, by Herbert P. Cole, Chief of Surgical Staff, Base Hospital, Camp Wheeler, Ga. Through the efforts of Dr. Simon Flexner, a War Hospital has been constructed on the grounds of the Rockefeller Institute. This institution is given over to the treatment of surgical cases resembling the pathological conditions found at the front. The methods of treatment found most efficacious under war conditions are here demonstrated under conditions of hospital management resembling those of a base hospital at the front.

Dr. Alexis Carrel and his staff, supplemented by other members of the Rockefeller Institute, present the course to members of the Medical Officers Reserve Corps assigned from the Surgeon-General's Office. A week is largely devoted to laboratory instruction and individual investigation into the merits of the more recent developments of the new surgery of the front. The second week is largely devoted to obser-

vation of cases and comparison of treatment results with the deductions from the laboratory. The entire course is supplemented with lectures, demonstrations and actual operations performed in the War Hospital.

The War Hospital is of the portable-section type following the accepted standards of the present-day base hospitals behind the firing lines. This hospital consists of fourteen one-story buildings of various sizes, constituting a complete working unit. Covered galleries connect the units. The buildings are given over to administration, laboratories, wards, kitchens, surgery, preparation, instruction and quarters for orderlies and nurses. Heat and light are furnished from the Institute plant. The refrigerating system is of the portable type and is applicable to field service.

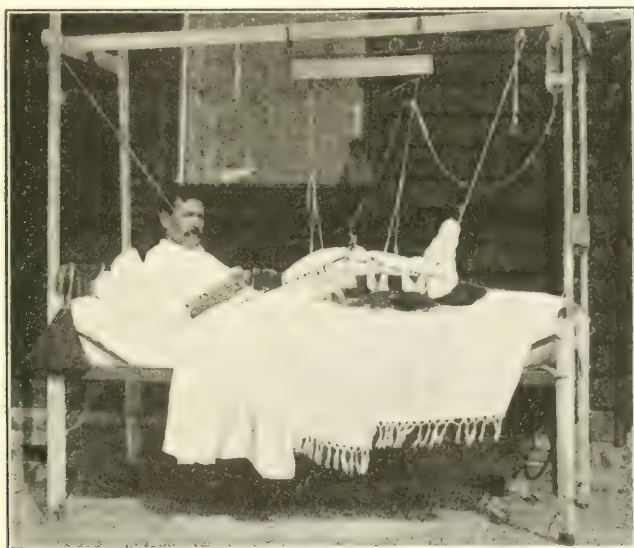


FIG. 94.—Balanced suspension treatment, with method of conveying Dakin's solution to the distributing tubes. It is comfortable, and greatly simplifies the dressings.

The entire construction is of the "take down" pattern, made up in five-foot sections of three standard lengths. The entire institution can be taken down and prepared for shipment in forty-eight hours. Reconstruction is facilitated by an ingenious method of bolting and truss support, all of standard and interchangeable form. Buildings of any size and pattern can be readily assembled with a minimum expenditure of time and labor.

The Carrel technic for administration of Dakin's fluid is the most striking feature of the course of instruction. The classes begin their instruction by preparing Dakin's solution after the present methods of manufacture. Sources of error are ascertained and the methods of preservation and determination of strength thoroughly investigated.

Each individual investigates the bactericidal properties of Dakin's

and other hypochlorite solutions, the comparative effects of Dakin's and many other solutions are determined in regard to living and dead tissues; the action in the presence of blood, pus and suture material.

The spirit of impartiality and true scientific investigation leaves no doubt in the minds of the classes as to the desire of the staff to set forth the principles of scientific investigation of wound treatment in its true light.

A number of infected and clean wound cases are in the wards and the Carrel technic is followed from day to day. The details of operative attention are demonstrated, the application of the tubes and methods of skin protection are carefully followed. Bacteriological examinations of the wounds are made every two days. The bacteriological examination methods are demonstrated and the methods of charting taught. Estimation of epithelization after the method of De Nouay is explained as a basis of estimating the effects of the treatment under the Carrel technic.

The methods of wound closure, skin grafting and paste treatment are shown. Practical demonstrations are participated in by the class, using manikins as subjects. The preparation of tubes, dressings and adjustment of apparatus are learned by practical work in the preparation rooms.

The modified Blake overhead fracture frame is explained in detail. This apparatus is the result of two years of investigation and application in the war hospitals at the front. One is readily convinced that it is the most valuable and complete equipment for the open treatment of fractures of the extremities by the Carrel method. The ease and facility with which patients with compound fractures may be dressed without discomfort is quite apparent.

Dr. Peyton Rous, of the Rockefeller Staff, demonstrates a short and simple method of the determination of agglutination. By his method one can readily determine the presence of a possible hemolysis in a prospective donor for transfusion. This should make even more practicable the employment of transfusion in primary and secondary hemorrhages at the front.

Dr. Bull, also of the Rockefeller Staff, demonstrates his method of producing the toxin of the Welch bacillus. He explains the method of antitoxin production in the horse and demonstrates the efficacy of the antitoxin in pigeons and guinea-pigs. The effect of Dakin's on the gas-bacillus toxin is demonstrated in the laboratory. Every indication points to the practical application of Bull's gas-bacillus antitoxin in the human being. This in itself will be one of the epochal features of war surgery investigations.

Dr. Auer, of the Rockefeller Staff, devotes an afternoon to the demonstration of the various practical methods of resuscitation. Particular attention is given to demonstration of resuscitation methods under war conditions. A very practical small portable apparatus is shown.

One cannot follow the teaching and demonstrations of Dr. Carrel and his staff without being imbued with a profound belief in the efficacy of the Carrel technic of wound treatment. The actual results wit-

nessed in the wards, together with the statistics of results obtained in the hospitals wherein the technic has been properly instituted, convince one that no matter how many more efficacious solutions may be brought to light, the treatment, as now carried on, is one of the surgical discoveries of the century.

The details of the preparation of the fluid and the essential elements of the treatment appear in a publication by Dr. Carrel, which, translated from the French, is now available in an American edition. This volume should be thoroughly perused before a criticism of the method is raised. Reports condemning the method of treatment do not warrant serious consideration, as most of them apparently emanate from institutions wherein the essential elements of treatment have not been considered.

A thorough knowledge of the correct method of application of the Carrel technic of wound treatment is indispensable to its successful utilization. Attention to the minute details, knowledge of the sources of error and ability to combat these errors are essential in the treatment. With all one may learn in the two weeks at the War Hospital, a month or more of actual working knowledge is required to master the details.

Any surgical method promising a reduction in mortality rate, material saving in hospital residence, and reduction of expense, commands serious consideration. The unquestionable results of the Carrel technic in these regards certainly warrant a fair trial on the part of the profession. A standardization of this treatment carried out by surgeons thoroughly trained in the procedure will undoubtedly help to establish the Carrel-Dakin technic in the position it should occupy in modern surgery.

The application of the Carrel-Dakin technic without careful attention to the essential details and without careful control of the bacteriological investigation of the wounds will certainly bring this valuable contribution to surgery into unwarranted disrepute.

Literature Favorable to the Carrel Method. Lloyd Noland,¹ of Birmingham, was one of the first, if not the first, industrial surgeons to go to France for a special investigation of the Carrel method. He read his paper before the Southern Medical Association in November, 1916, and has introduced this method for the treatment of accidental wounds in the great industrial plant of which he is chief surgeon.

William O'Neill Sherman,² of Pittsburgh, another industrial surgeon, went abroad at the same time as Noland and has written a very elaborate article. Sherman was invited to discuss Carrel's presentation before the Medical Section of the National Council of Defense at its recent meeting in the Rockefeller Institute.

Joseph S. Lawrence,³ a graduate of Johns Hopkins and a trained bacteriologist, after his return from France was of great assistance in

¹ Southern Medical Journal, 1916, ix, 1056.

² Surgery, Gynecology and Obstetrics, 1917, xxiv, 255, and Journal of the American Medical Association, 1917, lxix, 185.

³ Johns Hopkins Hospital Bulletin, 1917, xxviii, 294.

introducing the Carrel method in Professor Halsted's service at the Johns Hopkins Hospital. He presents clearly the bacteriological side.

Charles L. Gibson,¹ of New York, presented before the American Surgical Association in June, 1917, the first resumé of Carrel's book. Dr. Gibson also had an opportunity to see the practical working of this method in Carrel's hospital and in Depage's great clinic.

H. H. M. Lyle's² communication is of especial interest, because it illustrates the balance suspension method for holding the splint and conveying the irritating solution. This apparatus, illustrated in Fig. 94, will probably be adopted by the Medical Department of the United States Army as one of the standardized appliances for wound treatment.

Colonel William H. Arthur,³ President of the Army Medical School, gives a very good summary and expresses the opinion that it is the most important contribution.

One will find it interesting to read Carrel's⁴ own short summary which he gave before the Army Medical School.

Depage,⁵ upon whom we must look as a great military surgical authority, has apparently adopted the Carrel method in all its details. In my opinion this must be regarded as a very definite approval. Depage has a huge, splendidly organized hospital, and as a surgeon he is held in the highest esteem by all his colleagues.

O. Hirschberg⁶ makes the only German report I have been able to get, and it is most favorable.

Piessinger and Moiroud⁷ report very favorable experience when the treatment was instituted after the development of the gangrene associated with different types of aërobic and anaërobic bacteria. Apparently they used Dakin's fluid, but not the complete Carrel treatment.

SUBSTITUTES FOR CARREL'S METHOD. We find in the literature numerous attempts to obtain a substitute for Dakin's fluid. Some surgeons are of the opinion that the solution is difficult to make properly, and is unstable. Others are of the opinion that it is unsatisfactory. Dakin himself is looking for a substitute, as shown in the report of Dakin, Lee, Sweet, Hendrix and Le Conte.⁸ They recommend *dichloramine-T*. This paper was read by Le Conte before the American Surgical Association in June, 1917, and again before the Medical Section of the National Council of Defense when it met at the Rockefeller Institute. From their laboratory and clinical findings, they are of the opinion that dichloramine-T is less irritating to the skin; as it is a stronger germicide, the wound needs to be irrigated only once in twenty-four hours. It can be used as a substitute for iodine. As it dissolves blood clot, all vessels must be ligated, whether they are bleeding or not.

¹ Annals of Surgery, 1917, lxvi, 262.

² Journal of the American Medical Association, 1917, lxviii, 107.

³ Military Surgeon, May, 1917, xl, 489.

⁴ Ibid., April, 1917, xl, 479.

⁵ Journal of the American Medical Association, 1917, lxviii, 793.

⁶ Deutsch. med. Wehnschr., December 21, 1916, xlii, 1581; review in Journal of the American Medical Association, 1917, lxviii, 743.

⁷ Paris médicale, September, 1916, vi, 242; review in Journal of the American Medical Association, 1916, lxvii, 1260.

⁸ Journal of the American Medical Association, 1917, lxix, 27.

According to a recent editorial,¹ there have been some unfavorable criticisms of both the Dakin solution, as employed by Carrel, and the new solution chloramine-T. Wright is of the opinion that Dakin's solution has no antiseptic power. Le Grand and Delbet are of the opinion that Dakin's solution destroys the natural defense of the serum. British surgeons, Browning, Gulbransen and Thornton, prefer brilliant green, others acriflavin.

Wright's Lymph Lavage. Wright, Tanner and Matson² describe and illustrate a multiple rubber-tube irrigating apparatus, somewhat of the ordinary garden water-tap type. They are of the opinion that Dakin's fluid is yet less useful than salt solution, because with the former the solution must be cold, while the latter can be kept warm. They seem to be of the opinion that the heat of the solution is important.

There are other articles by Wright.³ These are considered in an editorial.⁴ Wright's treatment has been fully discussed here in previous numbers of PROGRESSIVE MEDICINE. He apparently accepts neither Carrel's principles nor his technic.

Kenneth Taylor⁵ seems to express the views of the majority against Wright's methods. He says, aside from the claims of its author, there are only scattered reports favorable to lymph lavage. Taylor has tried it extensively clinically, and is disappointed in its results.

Kenneth Taylor's Work. This bacteriologist has been especially interested in the study of the effect of different antiseptics on the various bacteria in infected wounds. He is rather of the opinion that different organisms must be destroyed by different agencies. He was the first to try quinine for gas-bacillus infection. He⁶ has also called attention to the importance of tissue fragments (foreign bodies) as foci which keep up the infection of the wound. All authorities seem to agree as to the importance of the primary operative measures. The wound should be cleaned, and no fragments of devitalized tissue left behind. They become a ready soil for the incubation of bacteria, and make sterilization of the wound more difficult.

Taylor⁷ discusses the specificity of antiseptics in detail, and claims that further investigation will bring out a method by which the wound is disinfected by a successive application of different antiseptics more or less specific for the bacterial flora of the wound under treatment.

In another article⁸ he studies the action of bacteria and different antiseptic solutions on catgut ligatures. He finds that only the gas bacillus eroded catgut. As I have noted, Carrel prefers catgut to silk.

¹ Boston Medical and Surgical Journal, September 6, 1917, clxxvii, 329.

² Lancet, 1916, cxc, 821; review in Surgery, Gynecology and Obstetrics, 1917, xxiv, Abstr. 351.

³ British Medical Journal, August 26, 1916, i, 286; A. E. Wright: Lancet, June 23, 1917, i, 939; September 16, 1916, ii, 503.

⁴ Journal of the American Medical Association, 1916, lxxvii, 1304.

⁵ British Medical Journal, September 2, 1916, ii, 321; review in Journal of the American Medical Association, 1916, lxxvii, 1117.

⁶ Annals of Surgery, 1916, lxiv, 641.

⁷ Lancet, February 24, 1917, i, 294; review in Journal of the American Medical Association, 1917, lxxviii, 1008.

⁸ Journal of the American Medical Association, 1917, lxxviii, 1533.

We must use one or the other. Apparently, at the present time, chromic catgut is the best. In my own work, for large vessels I use both chromic catgut and silk in double ligature.

Taylor¹ suggests, in his paper on secondary hemorrhage, that it may be due to the digestive effect of sodium hypochlorite solutions. Carrel, in a personal communication, answers this well. He says that the chief cause of secondary hemorrhage is suppuration. If his treatment is properly employed, there will be no suppuration and therefore no secondary hemorrhage.

In August, 1917, Taylor² summarizes the different methods of treating wounds. He says it is very difficult to compare two methods conducted by different men. Each surgeon is apt to vary in the details. Much depends upon the delicate and careful handling of tissues. The difference in results may vary with the patient, the age of the wound, its previous treatment, the varying conditions within the wounds themselves, the location of the wound, the presence of foreign bodies and necrotic tissue.

He then discusses three ways for comparison: First, groups of selected cases. They should be selected, because they have factors in common. Take a single group of wounds as near alike as possible, and treat them in different ways. Another system is to compare large groups of unselected cases, but this is cumbersome.

The most satisfactory method is to treat two or more wounds on the same individual by different methods.

However, in this article, Taylor does not give us his method of treatment of wounds. Carrel, on the other hand, gives us a precise method, and, so far as I am able to ascertain, no one else has yet done this.

I have been reading the literature on the treatment of wounds for a quarter of a century. I learned much from my teacher, Halsted, in the treatment of infected wounds, but our experience has always been limited. On the whole, we looked on our results as favorable. Nevertheless, during all of this time, no precise method has been developed which can be compared with Carrel's.

Secondary Suture. As I have repeatedly stated, we must require something more than lowered mortality and a smaller number of amputations in estimating our results of the treatment of infected wounds in war. I am impressed most with the factor, easily to establish when we compare methods, that is, the successful secondary suture. This not only shortens the period of disability and returns more men to the firing line after shorter periods of inactivity, but also allows the earlier introduction of reconstructive or function-restoring methods. It is difficult to attack nerve injuries and aneurysms in the presence of suppuration. The measures to restore function of muscle and tendon are difficult as long as there is an open wound.

In comparing results of the treatment of infected joints, we, of course, must be influenced by the saving of the limb, but we should be more

¹ Practitioner, May, 1917, xcvi, 413; review in Journal of the American Medical Association, 1917, lxviii, 1786.

² Journal of the American Medical Association, 1917, lxix, 381.

influenced by the saving of joint function. Many methods of arthrotomy and drainage at once check joint infection, but, in the majority of cases, they result in ankylosis. At the present time it is very difficult to get at the actual results.

Depage¹ reports on 75 cases of open fracture in which the wounds were closed by secondary suture. His patients arrived from two to six hours after being wounded. The wounds were immediately opened and cleaned according to the established methods. Then followed the typical Carrel treatment. The wounds were closed, as a rule, in from four to six days. Of course, in cases received so early, we have not the supreme test. In my own experience, with a few cases of compound fracture in civil practice, we have accomplished the same results, but, as I look back over my previous experience, we seldom failed in a compound fracture which was brought to the hospital within six hours after the injury.

Penhallow² reports and illustrates a number of cases of gunshot wounds, chiefly of the soft parts, closed by secondary suture. The experience was in the American Woman's Hospital in Paignton. He does not state the duration of time between the injury and admission to the hospital. I get the impression that some were late cases. He does not state specifically that Carrel's treatment is used, but he speaks of the first treatment as a thorough opening of the wound, followed by dressing with hypochlorous solution. Bacteriological control is not mentioned. The secondary suture is done from four to seven days after the granulations appear healthy. The patient is again anesthetized, the granulation tissue and surrounding skin are cleaned with ether and then iodine is applied. The wound is then excised and closed with mattress sutures of heavy silk, tied over rubber tubing. In addition, there is a small drain. As I read the details, all the wounds were of the soft parts, none particularly deep, so that they were operating upon superficial wounds, that is, excising practically a clean ulcer.

Marchak³ reports on successful secondary suture of wounds after preliminary open treatment in which magnesium chloride was employed. The preliminary treatment was continued for seven to ten days.

Morrison⁴ uses bacteriological control before secondary suture. He employs it chiefly in soft-part wounds.

Tavernier⁵ practically employs Carrel's technic before secondary suture, while Chalié⁶ discards all antiseptics, operates early before signs of infection, cuts out the wound and sutures it in layers. The following remark makes one suspicious of his results: "Constant supervision is necessary to be ready to open up the wound again if symptoms develop."

Military Orthopedics. It is fortunate for us that Colonel Robert Jones, of Liverpool, has been recognized by Surgeon-General Sir Alfred

¹ Bull. et mém. Soc. de chir. de Paris, 1917, xliii, 477; review in Surgery, Gynecology and Obstetrics, 1917, xxv, Abstr. 133.

² Military Surgeon, March, 1917, xl, 274.

³ Surgery, Gynecology and Obstetrics, 1917, xxiv, Abstr. 519. ⁴ Ibid., p. 565.

⁵ Lyon Chir., 1917, xiv, 12; review in Journal of the American Medical Association, 1917, lxviii, 1877.

⁶ Ibid., p. 35.

Keogh, Director-General of the British Army Medical Service, and given full authority over the problems in military orthopedics. Colonel Jones's title is Inspector of Military Orthopedics of the British Royal Army Medical Service.

His¹ book, published in March, 1917, comes at the most opportune time for the benefit of the surgeons in the Medical Reserve Corps.

Colonel Jones's book is dedicated to King Manuel who since his dethronement has lived in England and has done so much for the so-called orthopedic center established for the reconstruction and reëducation of disabled soldiers.

The experience of this war has demonstrated that over 50 per cent. of the wounded present orthopedic problems, and that the majority of general surgeons, well-trained in other branches of surgery, are deficient in the knowledge of orthopedic practice.

Colonel Jones has demonstrated that orthopedic surgery is a first, and not a third-line problem. In all wounds of the extremities, no matter what their character, from the onset one must not only think of the best treatment of the infected wound, but must bear in mind and provide from the very beginning for the restoration of function to this injured limb.

A report has recently come from England that some 300 wounded soldiers were returned to London as hopeless cripples, unfit for further duty in the ranks. Within one year trained orthopedic surgeons were able to return to the firing line 225 of these supposed hopeless cripples.

One could imagine how much time would have been saved and how many more could have been returned, had the skill and experience of the orthopedic surgeons been available in the first line.

I called attention to this in *PROGRESSIVE MEDICINE* for December, 1915 (p. 272), in discussing the after-treatment of wounds, and gave there in detail the so-called Twelve Commandments bearing on the prevention of crippling. These rules were printed and placed in every German Hospital throughout the zone of advance.

In *PROGRESSIVE MEDICINE*, since 1899, I have attempted to emphasize that rules of this kind were neglected in time of peace, because general surgeons in the treatment of fractures, diseases of the joints, and after all operations for lesions of the extremities, failed to recognize those measures essential for the early restoration of function. The inferior results were somewhat lost sight of in time of peace, but now, in war, the number of such cases is so great that the results have become appalling.

Fortunately, the Surgeon-General of the United States Army and his staff recognized at once the necessity for special training in military orthopedics, and very shortly after war was declared a group of orthopedic surgeons went to England with Goldthwaite, of Boston, to study the methods developed under Colonel Jones.

Major Goldthwaite, who has just returned from this experience, remarked in his report before the Medical Section of the National

¹ Notes on Military Orthopedics, Cassell & Co., Ltd., London, 1917; Paul B. Hoeber, 67-69 East 59th Street, New York.

Council of Defense, that he left for Europe firmly convinced that orthopedic surgery was chiefly a third-line problem, but returns completely satisfied that it is mainly a first-line problem, and that most of this orthopedic treatment should be completed in France. No wounded soldier should be returned to this country until the experts have demonstrated that nothing further can be accomplished there in order to restore him to service in the army on the firing line.

Blake, of the American Ambulance, recognized at once the importance of military orthopedics, and his hospital was a marvel of appliances for the fixation of the extremity with extension, and the early restoration of function during the healing of the wound.

I discussed this in *PROGRESSIVE MEDICINE* for December, 1915, and reproduced the illustrations (Figs. 50 to 69) of Osgood who was the orthopedic surgeon of the Harvard Unit to the American Ambulance in Paris.

Crile and Cushing, on the return from their experience in Paris, emphasized the important fact that every surgical unit should be provided with an orthopedic expert.

In view of this feature which seems to be a development of the present war, we find ourselves in this country solely lacking in trained orthopedic surgeons. A group in the Surgeon-General's office—Brackett, Goldthwaite and Lovett—taken from the great orthopedic center in this country (Boston) are working out this problem. Surgeons practising orthopedics in this country are, as I have already mentioned, being sent to England for instruction under Jones. Surgeons without experience in this domain, are being selected for intensive training in an orthopedic center in this country, after which they will be ordered for further instruction to England and France. In this way the Surgeon-General will undoubtedly be able to provide a sufficient number of trained men to meet the requirements of military orthopedics.

It is an example of one of the great opportunities that this war offers to the medical profession for special training.

The number of orthopedic surgeons in this country is by no means sufficient for the needs in time of peace. Here, therefore, is a great opportunity for a young surgeon to receive, without expense, orthopedic training of a character hardly possible in time of peace in the same period. I know of a few young, well-trained general surgeons who have embraced this opportunity. The benefit, therefore, will be realized not only in this war, but after the war by the community at home.

The seven chapters of Colonel Jones's book are as follows:

1. Position of election for ankylosis following gunshot injuries of joints.
2. Suture of nerves, and alternative methods of treatment by transplantation of tendon.
3. The soldier's foot, and the treatment of common deformities of the foot.
4. Malunited and ununited fractures.
5. Transplantation of bone, and some uses of the bone graft.
6. Disabilities of the knee-joint.
7. The mechanical treatment of fractures under war conditions.

PLASTER OF PARIS. Before discussing in detail the text of Colonel Jones's book, I wish to emphasize his remarks in regard to plaster. On page 61 he writes: "I would not condemn the use of plaster altogether, much as I dislike it, but it should be used with discrimination. It should be fixed in such a way that the limb remains in extension and good alignment, and that the circulation of the limb is in no way hampered."

THE MECHANICAL TREATMENT OF FRACTURES UNDER WAR CONDITIONS. In my discussion I will begin with his last chapter first, because the beginning of orthopedic treatment is the proper fixation of the injured extremity. Some of the splints illustrated and advocated by Jones have been reproduced and discussed in the pages devoted to Colonel Goodwin's book on *War Surgery*.

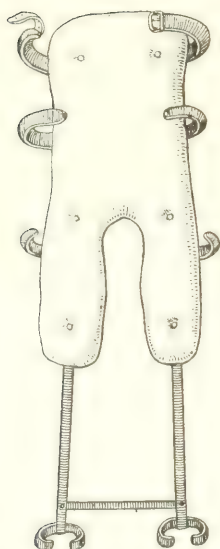


FIG. 95.—Thomas's double frame.
(Jones.)

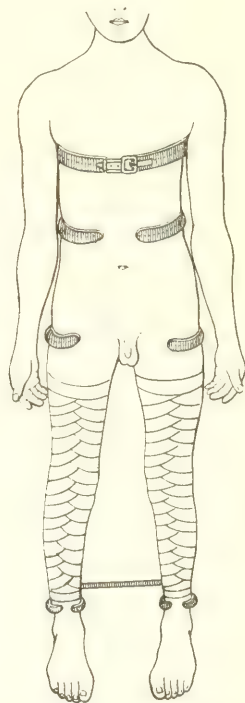


FIG. 96.—Thomas's double frame
applied. (Jones.)

Jones remarks that the methods of fixation employed must be efficient and simple; easy and painless access to the open wound must be provided in the immobilization of the limb, not only during the first transportation, but subsequently until the wound has healed.

Although a few splints may meet the requirements of the majority of the wounds, yet there will be a few which will require modifications on account of the position and severity of the wound.

Plaster of Paris becomes a filthy method, and Colonel Jones urges young surgeons at the front to discard it altogether.

Fractures through the Lower Spine and Pelvis. For this lesion Jones advises a double Thomas frame (Figs. 95, 96 and 97). Place the patient upon the frame, bandage the limbs, press the body and leg-wings into

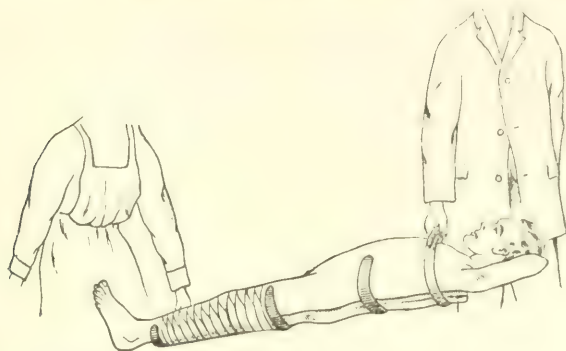


FIG. 97.—Method of lifting patient on Thomas's double frame. (Jones.)

position to prevent side movements. When there is a wound on the posterior surface, change the shape of the pad (Fig. 95) to allow access to this wound.

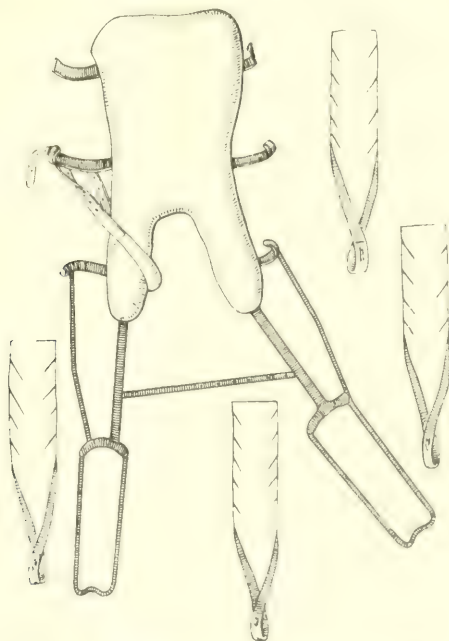


FIG. 98.—Left abduction frame. (Jones.)

In nursing patients on a double Thomas frame, do not turn them, but place a block underneath the bar between the ankles (Fig. 96) to relieve pressure on the heel, raise this block higher when the patient requires the bed-pan, or when he is washed, or the wound dressed. The

patient should never be taken from this frame, and only the exposed skin should be washed. The feet should be supported at right angles and protected by the usual basket from the weight of the clothes.

Fractures of the Hip and Upper Thigh. For fractures in the region of the neck and trochanter of the femur, Jones advises a modification of the Thomas splint with an "abduction frame" (Fig. 98). A patient so fixed can be transported, and easily lifted; extension is easily applied and maintained (Fig. 99). When the patient must be transported, the abduction can be temporarily abandoned (Fig. 100).

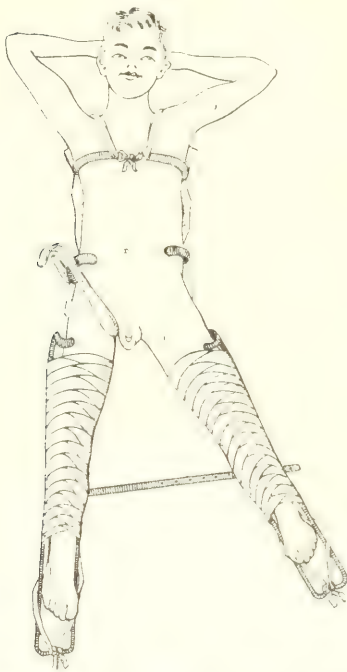


FIG. 99.—Left abduction frame applied.
(Jones.)

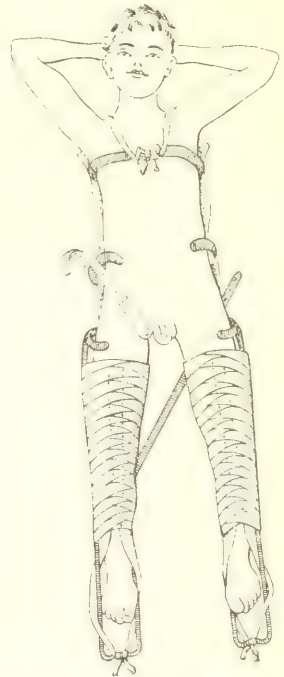


FIG. 100.—Left abduction frame;
limbs parallel for transport.
(Jones.)

When the patient is placed upon this abduction frame, any displacement of the bone should be overcome by extension; the limb should be rotated in, until the foot is at right angle, and then fixed in this position on the frame. The fixation of the body to this frame and the counter-extension from groin and shoulder are shown in the illustrations with such great clearness that a description is unnecessary.

Jones apparently agrees with Whitman that fixation in abduction accomplished and maintains reduction of the fragments better than any method by weight and pulley extension.

The fixation in the abduction frame prevents the recurrent muscle spasm so often observed in the usual method of extension. The nursing of a patient fixed in the abduction frame is simpler.

Jones is of the opinion that the long Liston splint is unsuitable for fractures of the upper thigh, as it does not permit abduction, and for this reason leads to very troublesome deformities. The former difficulty of the abduction frame (Fig. 95) which was fixed and made transportation in abduction difficult, has been obviated by a change in the splint which allows both limbs to be placed in a parallel position during transportation (Figs. 99 and 100). When the patient arrives at his destination, the limb can be abducted without disturbing the dressing at all.

In the abduction frame, the patient can be lifted without discomfort and without disturbing the fracture. The wound can be dressed as frequently as necessary without interference to extension. Where there is a wound on the buttocks, the pad can be modified (Fig. 101) to allow the dressing of the wound without disturbing the patient on the frame.

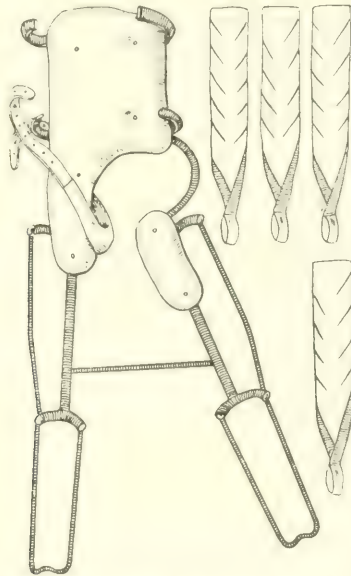


FIG. 101.—Modified abduction frame for pelvic wound; only to be used while wound discharges. (Jones.)

The nurse should be instructed never to turn the patient on the abduction frame, but follow the directions already given for nursing in the Thomas double frame. The only practical difference is that one of the limbs is in abduction. In the abduction frame, the groin strap should be removed at four-hour intervals for five minutes during the first day of treatment; after that twice daily. When the patient is on the double Thomas splint, none of the bandages are removed.

There is apparently some discrepancy in Jones's statement. On page 113, he writes: "The groin strap should not be slackened by the nurse under any pretext, but the skin should be moved to and fro over the adductor muscle." On page 116, he writes, as I have quoted above:

"Remove the groin strap for five minutes, etc." These directions both apply to the abduction frame. There are no groin straps in the Thomas double frame. I gather from this that the nurse is allowed to remove the groin strap for a few minutes at intervals, but never to relax it, as this is a very important part of the extension.

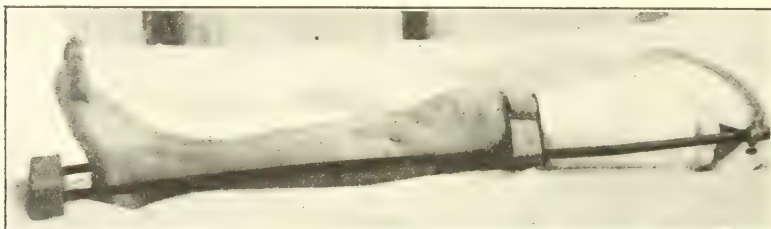


FIG. 102.—(From Osgood's collection, Harvard University Unit.)

The relation of the groin strap in fractures of the neck and trochanter when the limb is in abduction will be discussed later. Perhaps it will be found that this is not an essential feature of the abduction frame, but I am giving in this review, as clearly and as closely as possible, Colonel Jones's personal opinion.

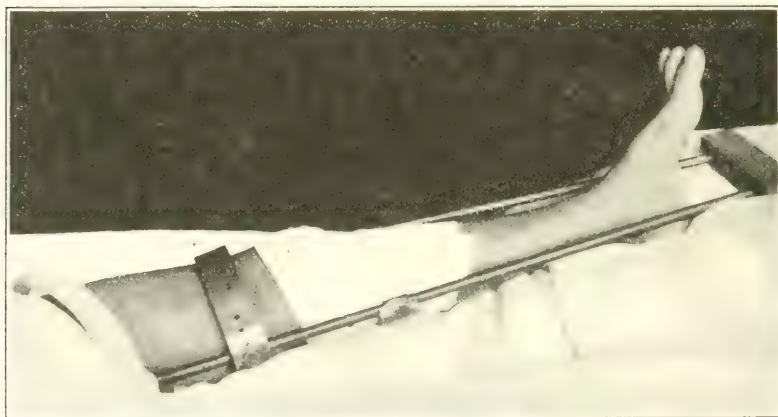


FIG. 103.—(From Osgood's collection, Harvard University Unit.)

Fractures of the Middle and Lower Thigh. Thomas's Splint. In *PROGRESSIVE MEDICINE* for December, 1915 (Figs. 102, 103, 104, 105 and 106), I called attention to this now most universally employed splint. Fig. 102 shows the application of the splint for the ambulatory treatment of fracture of the femur, Fig. 103 for any injury of the knee. Fig. 104 pictures the soldier walking in the Thomas splint. We observe in these three that the primary bandage placed on the limb, as shown in Jones's illustration (Fig. 107), is not employed. But when there is a severe compound fracture, it is employed (Figs. 105 and 106). Figs. 102 to 106 were sent to me by Dr. Osgood, of Boston. The absence of

the primary bandage for extension in Fig. 102 is due to the fact that the fracture is partly united, and there is required only fixation to prevent bending.

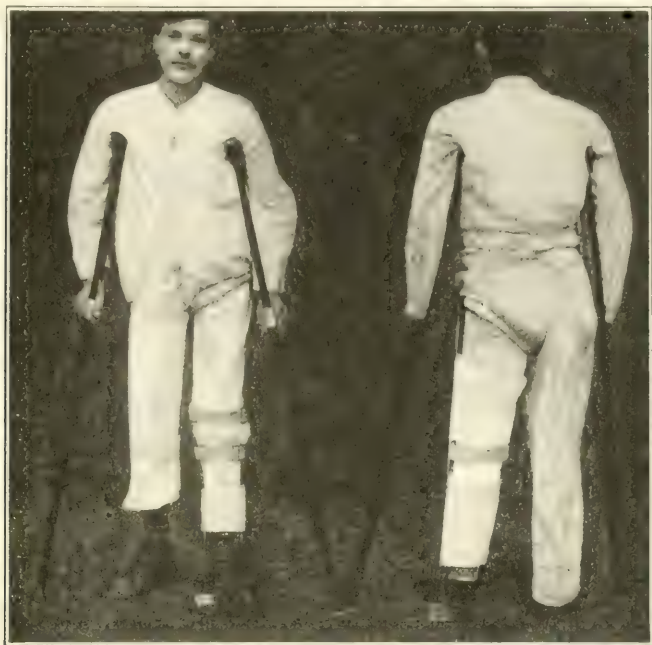


FIG. 101.—(From Osgood's collection, Harvard University Unit.)

This demonstrates that the Thomas splint is applicable throughout the entire treatment, a very important consideration in military surgery. The application of the Thomas splint for fixation and extension is shown in Figs. 107, 108 and 111.



FIG. 105.—(From Osgood's collection, Harvard University Unit.)

I demonstrated one of these splints before the American First-aid Conference in Washington in August, 1915. Major Darby brought one of them home from Europe at about this time. Notwithstanding

this, very little attention has been given to the Thomas splint in this country, and, during the three years in which we waited to enter the



FIG. 106.—(From Osgood's collection, Harvard University Unit.)

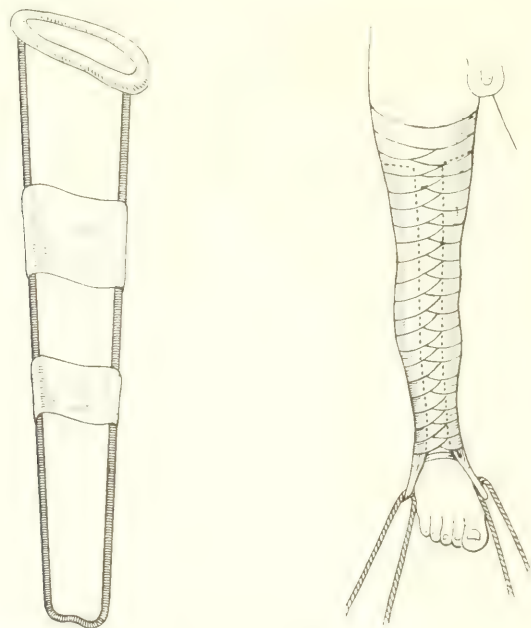


FIG. 107.—Strapping extensions applied to leg. Suspension slings to splint to support limb. (Jones.)

war, few surgeons have familiarized themselves with the splint which apparently will be employed more than any other from now on.

All of my students writing from the first dressing stations behind

the British lines speak of the Thomas splint as a life-saving appliance. Most recently, Lyman, a graduate of Johns Hopkins, a young surgeon of more than three years' hospital experience, writes me enthusiastically of this most readily adjustable and adaptable splint. Dr. Alexis Carrel told me in New York a few days ago that there is no reason why, in compound fractures of the lower extremity, a proper primary dressing of the wound with fixation of the limb in a Thomas splint should be disturbed at any of the subsequent dressing stations behind the regi-

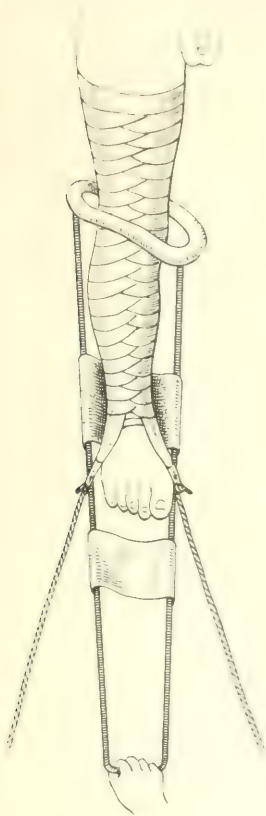


FIG. 108.—Introducing limb through ring of Thomas's knee splint. (Jones.)

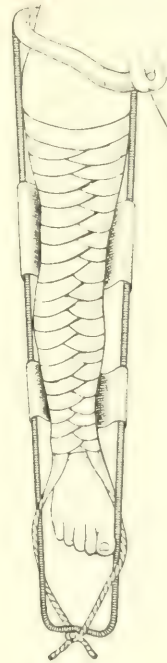


FIG. 109.—Knee splint in position, traction applied. (Jones.)

mental aid posts, until the patient reaches an operating room, where it is possible to anesthetize him, open the wound, and institute the Carrel-Dakin method.

Jones remarks that he has often fixed a fractured thigh in this splint and sent the patient home in a cab. He employs the Thomas splint for all fractures in the middle and lower third of the thigh, in the region of the knee-joint, and in the upper and middle third of the leg. The application of this splint is easy. Adhesive straps are applied in the usual way for extension. Through the lower end of the adhesive strap

extension there is attached a loop of webbing (Fig. 107). The adhesive straps are fixed with the usual bandage. The splint is then applied over the foot (Fig. 108) and adjusted as shown in Fig. 109. Extension is made as shown there. The foot must be kept at right angle.

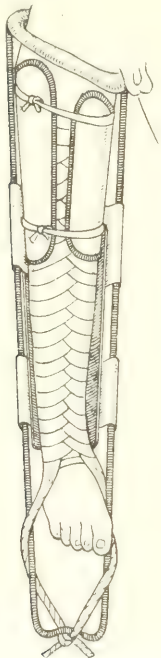


FIG. 110.—Thomas's bed knee splint with local splints applied. (Jones.)

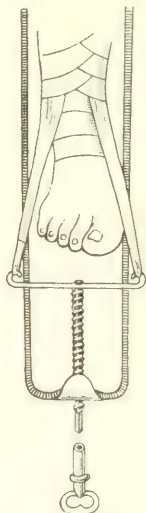


FIG. 111.—Screw extension which may be used with Thomas's knee splint or abduction frame. (Jones.)

Now local splints of block-tin or wood can be molded over the fracture as shown in Fig. 110. The advantage of the block tin or sheet iron is that the splint can be disinfected by heat, fire or water. In some cases screw extension, as shown in Fig. 111, can be applied. This method allows the patient to sit up and move about better.

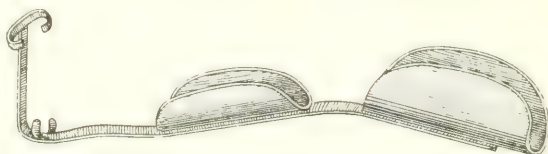


FIG. 112.—Skeleton splint for injuries near the ankle-joint. (Jones.)

In this splint special attention must be given to the perineum. Keep the leather ring and the skin clean.

Jones expresses the same surprise, that so effective and simple a splint has not been universally employed. In military surgery it is especially useful. It takes but a moment to put it on. Lyman writes

me that at the front they do not remove the patient's clothes or shoes, but put the splint right on the limb, use the shoe for extension, cut the



FIG. 113. —Skeleton splint applied. (Jones.)

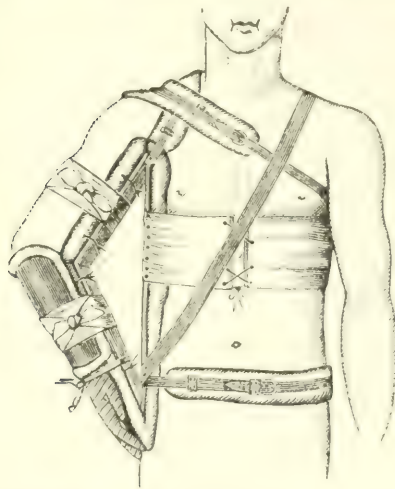


FIG. 114.—Middledorpf's triangle splint for fractures of humerus.

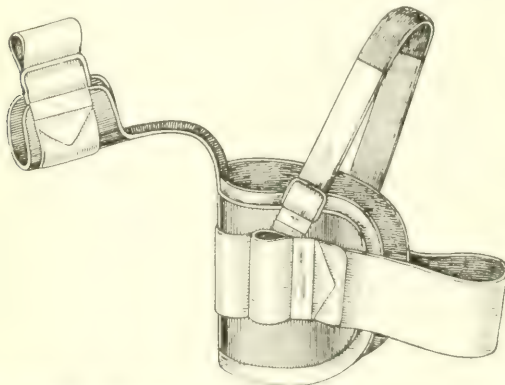


FIG. 115.—Splint to keep the arm abducted slightly forward and rotated slightly inward. (Jones.)

clothes, and cover the wound with sterile gauze, rapidly bandage, and transport the man to the rear at once.

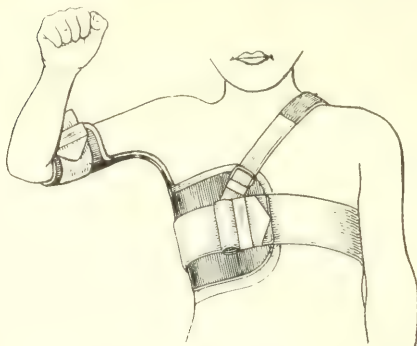


FIG. 116.—Splint applied to keep the arm abducted slightly forward and rotated slightly inward. (Jones.)

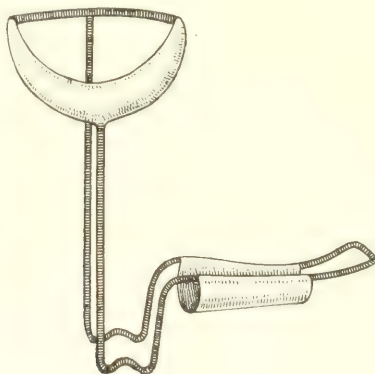


FIG. 117.—Modified Thomas's humerus extension splint. (Jones.)

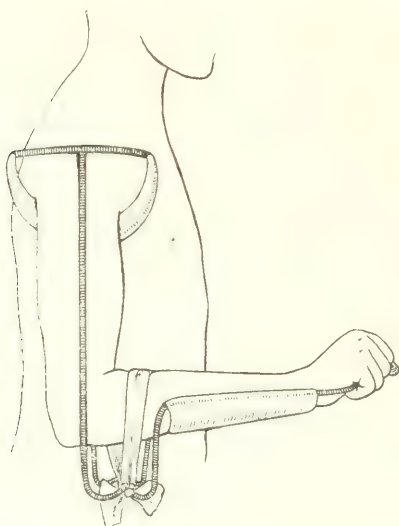


FIG. 118.—Modified Thomas's humerus extension splint applied. (Jones.)

Jones remarks that he has never had to plate a recent fracture of the femur.

Fractures of the Lower Leg and Ankle. Jones advises the employment of a skeleton splint (Figs. 112 and 113) which is easy of application

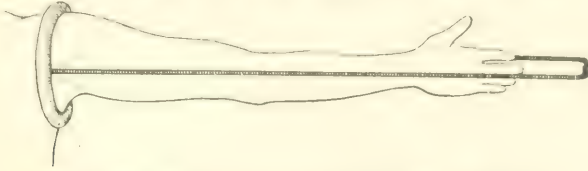


FIG. 119. Extension arm splint applied. (Jones.)



FIG. 120. (From Osgood's collection, Harvard University Unit.)

and allows access to almost any wound, and can be modified to suit the special case. As a rule, in gunshot wounds of the leg only one bone is broken, so that the problem of fixation is not as difficult as in industrial fractures when both bones are fractured.

Fractures of the Upper Arm. Jones employs the abduction position and uses a splint similar to that of Middeldorpf (Fig. 114) which has been described and pictured in *PROGRESSIVE MEDICINE* many years ago (December, 1902, p. 103, Fig. 14). The splint employed by Jones is shown in Fig. 115 and its application in 116. This position is not only best for the fragment in the humerus, but should there be ankylosis of the shoulder-joint, this is the best position for the ankylosis. Of course this position is not a good one for transportation, and

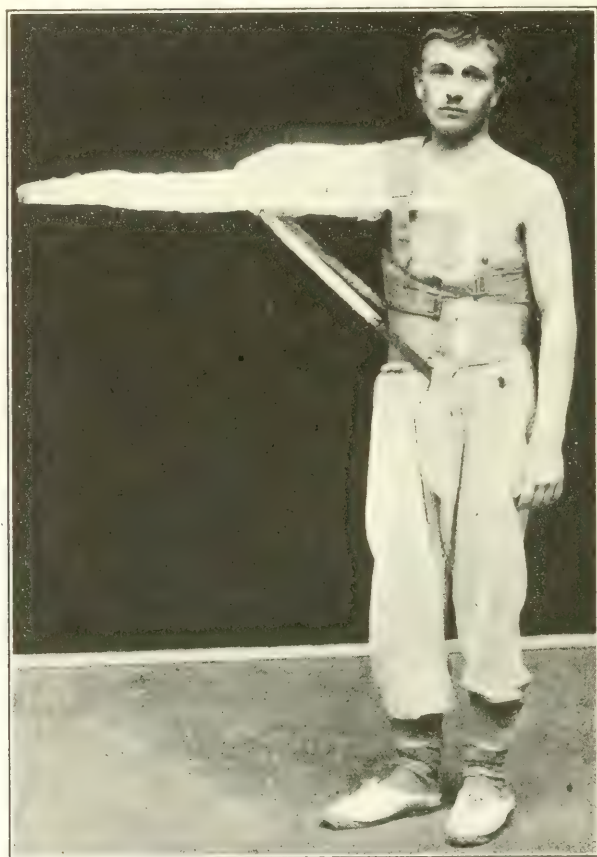


FIG. 121.—(From Osgood's collection, Harvard University Unit.)

need not be assumed until the patient reaches the base. As a front-line splint, one can employ a modified Thomas knee splint (Figs. 117 and 118). In a splint of this kind we get both extension and abduction. Later, when the patient is confined to bed, one can employ the Thomas splint without modification (Fig. 119). I am confident that in some severe injuries between the elbow and shoulder this Thomas splint (Fig. 119) will prove to be a splendid splint for the first dressing, and during transportation the arm can remain in full extension.

These abduction splints for the arm employed by Jones should be

compared with Figs. 120, 121 and 122 taken from the collection of photographs loaned me by Osgood, of Boston.

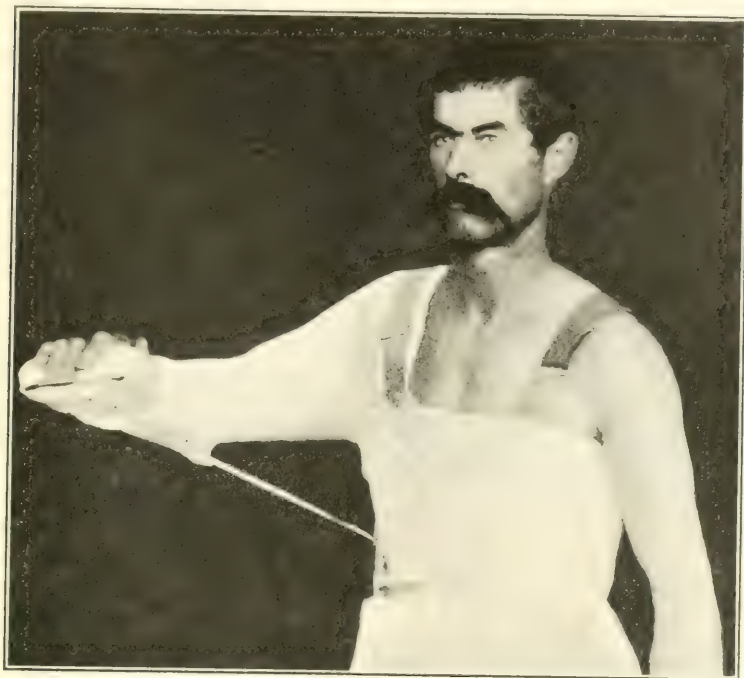


FIG. 122.—(From Osgood's collection, Harvard University Unit.)

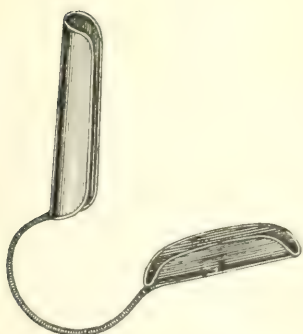


FIG. 123.—Splint immobilizing the elbow-joint but allowing access to it. (Jones.)

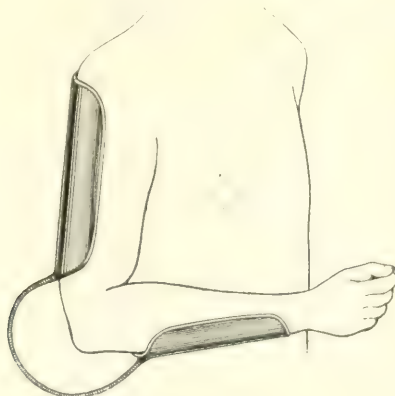


FIG. 124.—Elbow splint applied. (Jones.)

Fractures of the Elbow. Figs. 123 and 124 from Jones illustrate a simple splint which allows access to the wound in the region of the elbow. The forearm, if possible, should be flexed a little beyond right

angle. When the wound is suppurating, acute flexion is painful. I am inclined to the opinion, however, that a few days after the Carrel-Dakin treatment has been instituted any indicated position can be maintained with comfort.

This splint illustrated by Jones should be a convenient one for primary dressing at the front. It impresses me as simpler and more quickly changeable than the one employed by Osgood (Fig. 125). Osgood's splint was employed in a base hospital.

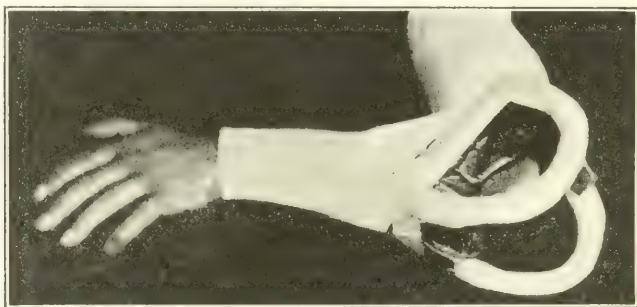


FIG. 125.—(From Osgood's collection, Harvard University Unit.)

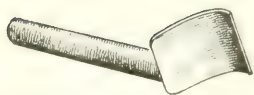


FIG. 126.—Hyperextension hand splint. (Jones.)

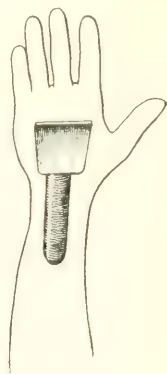


FIG. 127.—Hyperextension hand splint applied. (Jones.)



FIG. 128.—Skeleton hyperextension hand splint. (Jones.)



FIG. 129.—Skeleton hyperextension hand splint applied. (Jones.)

As one does not wish to multiply the number of splints in use with the primary dressing at the front, every effort should be made to employ the Thomas splint as much as possible.

Wrist and Hand. In gunshot wounds and injuries about the wrist and hand, Jones calls attention to the error of having the hand fixed

in line with the forearm instead of in dorsiflexed position. The splints that may be employed are illustrated in Figs. 126, 127, 128, 129, 130,

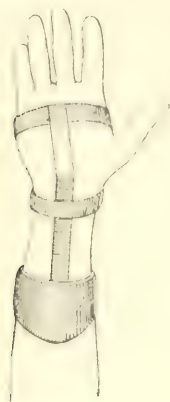


FIG. 130. — Skeleton hyperextension hand splint applied. (Jones.)

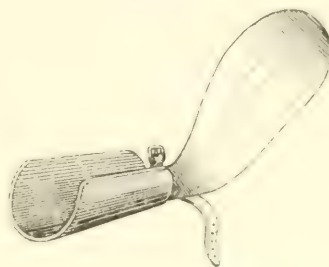


FIG. 131. — Long hand splint. (Jones.)

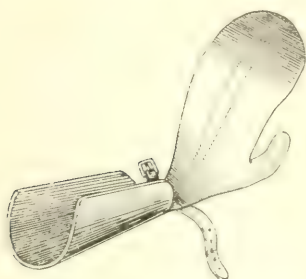


FIG. 132. — Long hand splint with thumb-piece. (Jones.)

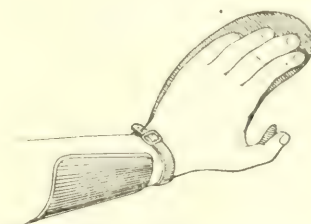


FIG. 133. — Long hand splint applied. (Jones.)

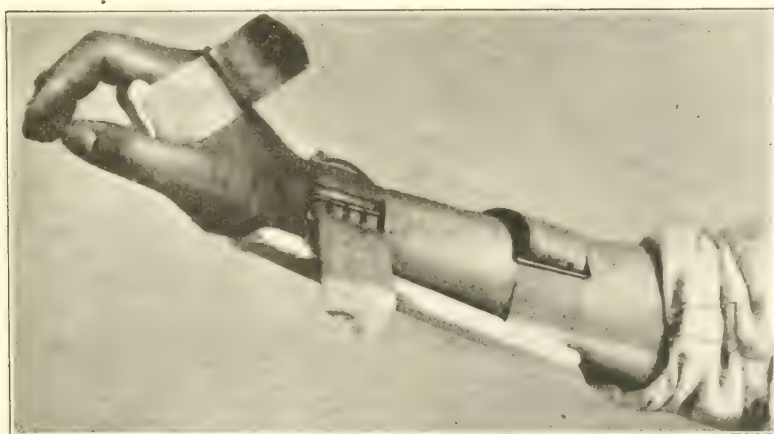


FIG. 134. — (From Osgood's collection, Harvard University Unit.)

131, 132 and 133. In all of these splints care must be taken for accurate adjustment between hand and splint to avoid strain on the carpal joint.

Osgood also called attention to the importance of the position of the hand, especially in injuries of the musculospiral nerve, and his simple splint is shown in Fig. 134.

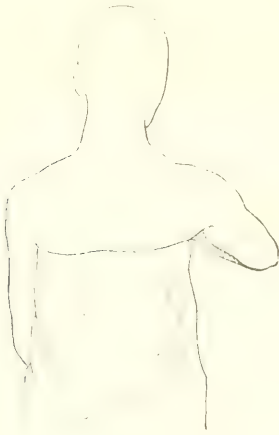


FIG. 135



FIG. 136

FIGS. 135 and 136.—To illustrate the position for ankylosis of the shoulder in abduction. (Jones.)

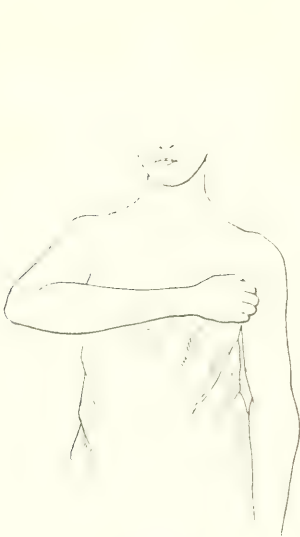


FIG. 137

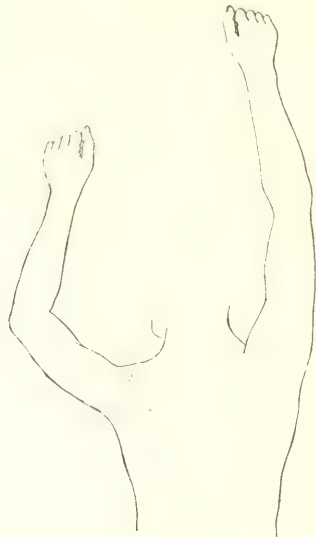


FIG. 138

FIGS. 137 and 138.—Ankylosis of the shoulder in abduction to show degree of abduction (Fig. 137) and the degree of power of lifting the arm (Fig. 138). (Jones.)

POSITION OF ELECTION FOR ANKYLOSIS FOLLOWING GUNSHOT INJURIES OF THE JOINTS. As this chapter comes first in the book it suggests

that Colonel Jones looks upon the position as perhaps of the most important and first consideration.

It is interesting to compare the positions advocated by Jones with that of the German surgeon, Ritschl,¹ but in making this comparison it is to be remembered that Jones is advising a certain position, when, from the nature of the wound, ankylosis may be expected.

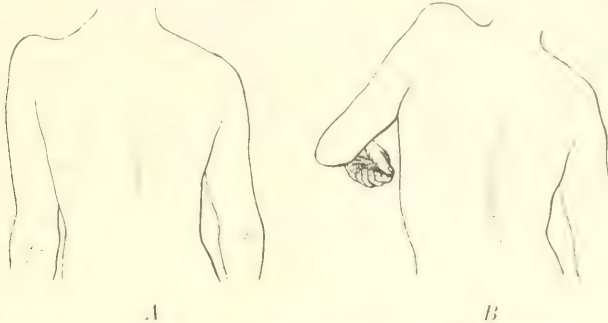


FIG. 139.—A shows faulty adducted position of arm, and B the consequent extremely limited power of abduction. (Jones.)



FIG. 140.—Ankylosis of elbow-joint at 70 degrees. (Jones.)

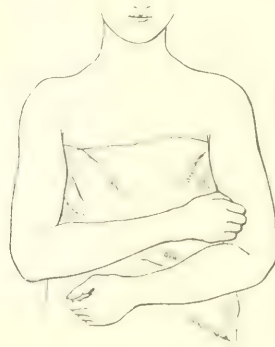


FIG. 141.—Right elbow at 110 degrees, left elbow at 70 degrees. (Jones.)

Shoulder-joint. The arm should be abducted to about fifty degrees (Figs. 135, 136, 137, 138 and 139), the elbow should be slightly in front of the coronal plane of the body (Fig. 136), so that when it is at right angle and the forearm supinated, the palm of the hand is toward the face. The arm is placed in this position, while the scapula retains its normal position of rest.

The arm should never be kept to the patient's side if ankylosis is anticipated.

An arm with the shoulder ankylosed in this position is much more serviceable than a flail shoulder-joint.

The shoulder-joint should never be allowed to become fixed at right angles to the side.

¹ PROGRESSIVE MEDICINE, December, 1915, p. 272.

These rules are for adults and not for children.

According to Ritschl, when ankylosis is not anticipated, the shoulder-joint should be maintained in its usual position of rest secured by a sling.

Elbow-joint. According to Jones, the position will somewhat depend upon the patient's occupation. In the majority of cases, the fixation at the elbow should be about 70 degrees (Fig. 140). When both elbows are ankylosed, one should be fixed at an angle of 110 degrees, the other 70 (Fig. 141).

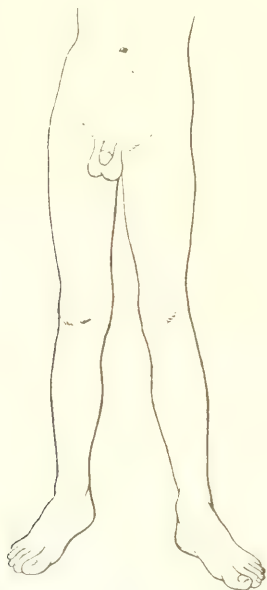


FIG 142



FIG. 143

FIGS. 142 and 143.—Ankylosis of hip. Fig. 142, correct position, in slight abduction with extended thigh and slight outward rotation. Fig. 143, faulty position of ankylosis in flexion with adduction and internal rotation. (Jones.)

Ritschl is of the opinion that during the after-treatment of the wound, the elbow-joint should be at a right angle.

Jones does not note the change in the flexion at the elbow for different occupations.

Forearm. When movements of pronation and supination are lost the radius should be fixed in a midposition. The hand in this position is more useful and of better appearance.

Ritschl advises a position of pronation.

Wrist-joint. Dorsiflexed position is a priceless surgical axiom, the neglect of which is grave. This position is also recommended by Ritschl.

Finger-joints. Ritschl recommends a slightly flexed position. They are not mentioned by Jones.

Hip-joint. Jones recommends the position of slight abduction with thigh extended and very slight outward rotation. The correct and faulty positions are shown in Figs. 142 and 143.

In my experience with fractures of the neck of the femur treated in this country, the usual result is shown in Fig. 143 and that is why the functional impairment is so great. Halsted many years ago wrote about the importance of abduction. Whitman has made it the chief factor in his treatment. Yet it is a very difficult thing to accomplish. Cases of this kind need constant supervision.

Ritschl advocates for the position of the hip-joint one of slight flexion and abduction, but as I have called attention in the beginning, it is a position best for the treatment of injuries when ankylosis is not expected.

Knee-joint. When ankylosis is anticipated, the position should be extended, according to Jones. If not, the best position is slight flexion, according to Ritschl.

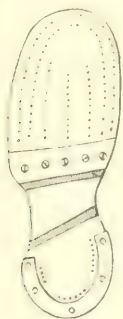


FIG. 144.—Boot with bar behind head to relieve injured metatarsal joints and phalanges from pressure. (Jones.)

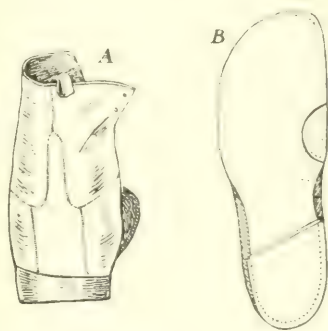


FIG. 145.—A and B, boot with straight heel elongated and raised $\frac{1}{2}$ inch on inner border, with small patch to thicken inner side of sole. (Jones.)

Ankle-joint. Toe-drop and valgus are very difficult to prevent unless everyone in charge of the case practises eternal vigilance. We should have a sign to hang from the head of the bed: "Keep the foot at a right angle with the leg, in slight varus, rather than valgus position." This is the position recommended also by Ritschl.

Tarsus and Metatarsus. Jones cautions us to bear in mind the static deformity of flat and pronated foot. In applying bandages and apparatus to prevent this, constantly think of corns and callosities due to improperly adjusted pressure. Cases of injury to the foot should be protected by bandage or shoe until the injury in the region of the arch has healed, and in the majority of cases some protection in the shape of an arch support or special shoe may be necessary for a longer period. In peace time, I am familiar with many apparent failures after operations on the foot, because the surgeon was not familiar with the after-treatment and did not provide for this support. Fig. 144 is a boot employed by Jones to relieve injured metatarsal joints and phalanges from pressure. Figs. 145, A and 145, B show another special boot.

FRACTURES, MALUNITED, UNUNITED AND COMPOUND. Colonel Jones, in Chapter VII, when describing the mechanical treatment of fractures under war conditions, makes the following very important statement: "A word of warning against the destruction of loose pieces of bone removed from the wound. If quite loose, they can be taken out, cleaned and replaced. Suppurating compound fractures unite well if given time; a common source of failure is due to the removal of bone."

A large percentage of war wounds are compound fractures. The first two problems which must be given immediate attention are the treatment of the wound and the fixation of the limb. In another chapter I will discuss wound treatment when I review one of the great contributions of the war by Carrel and Dehelly. I have already called attention to the chapters by Jones on mechanical fixation and position of the limb.

When infection is combated, more attention can be given to the comminuted bone and to nerve injury, as well as to joint complications.

Jones's description of the factors in delayed union should be read in the original, he claims that the majority of the factors are under our control.

He calls attention to one point which is constantly overlooked by the majority of even experienced surgeons. In many cases of fracture there may be several weeks of apparent inactivity in callus formation. Then, suddenly, consolidation occurs. With this knowledge, and patience, the good practitioner continues his careful treatment, maintaining an apparatus to prevent angular deformity, with the cheerful confidence that although union may be delayed, it will ultimately take place without further treatment.

When the indications for the treatment of the fracture are properly met, one should have no anxiety when union is delayed.

It is to be recollected that irrespective of the nature of the fracture, delayed union is most common in the middle of the femur, in the humerus at the junction of the middle and upper third, and in the lower third of the tibia and fibula.

There may be delayed union even though the fragments are in perfect position, while union may be rapid although the fragments are in bad position.

The most obvious and frequent cause of faulty union, whether united or not, is inefficient reduction of the fragment. Apparently, Colonel Jones here is talking about fracture in time of peace. In compound fracture due to gunshot injuries, the fragments are usually comminuted, the soft parts torn, so that there is not much difficulty in reduction, and the chief cause of faulty union is infection.

However, we must emphasize, with Colonel Jones, that in war surgery as well as in peace surgery the fundamental principle in the treatment of fractures is to secure and maintain good length and good alignment. All of the splints which I have illustrated from Colonel Jones's book have for their fundamental principle alignment and extension in the position best for function. Again, we should all agree with Colonel Jones as to the danger of circular compression by splint or bandage.

That is why he condemns plaster of Paris. Jones writes that in all splints one should be able to put the finger between the splint and the limb. Think of extension, alignment, position of the limb and joint, and good circulation. If you do, you will not have to think of the comfort of the patient, or worry about the result, even if there is apparent delayed union.

The average time for solid union, especially in the lower extremity is much longer than four or five weeks. Many faulty results have been due to allowing the patient to bear weight without a supporting splint and to bend the soft callus which, when examined in the ordinary way, gave the impression of firm bony union.

When Colonel Jones speaks of the treatment of delayed union he calls attention to the fact that Thomas (Fig. 146) employed and advocated hyperemia twenty years before Bier.



FIG. 146.—“Damming” or congestive treatment of ununited fracture of the humerus by Thomas’s method. (Jones.)

For non-union in good position, all other means should be exhausted before operation. As a rule, if the case is seen in the eighth week, extension, alignment and improved circulation will accomplish results. Later we may have to try the various methods of hyperemia, or, under anesthesia the region of the fracture is traumatized. In other cases, under extension, the area of fracture is exposed, and, according to indications, the interposing callus excised or not, and some form of autogenous transplant made. The various forms for the tibia are shown in Figs. 147 and 148.

Although it is not mentioned by Jones, I get the impression that in reconstruction work, especially in those wounded early in the war, there will be large opportunities for bone grafting, because many surgeons, in their endeavor to clean the wound of foreign bodies and bacteria cleaned out with this the pieces of bone. The primary healing of the wounds so treated was really marvellous, but the ultimate result pitiful, because the individual was left with an ununited fracture or a flail limb. Jones speaks of this on page 65 as one of the causes of non-union in gunshot wounds.

The correction of weak union of six to seven weeks’ duration is one of Colonel Jones’s arts, especially in relation to Colles’s and Pott’s fractures. Under anesthesia, by powerful manipulations with the hands, aided in some cases with mallet and wrench, these faulty united fractures in

which union is still weak, are reduced almost as if they were fresh fractures. The probabilities are that Jones has not seen much of this in war surgery.

I am confident that, in gunshot fractures, the most important point to have in mind is extension and alignment. Then, later, after there is some callous formation, one should not forget that an apparently united fracture may bend. I will not review here more of Colonel Jones's chapter on malunion, because it is more applicable to fractures not usually seen in war surgery.

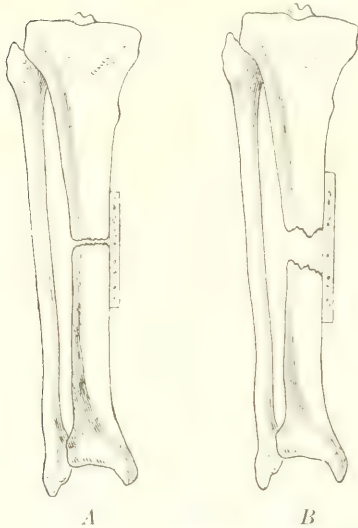


FIG. 147. — Bone grafting. *A*, lateral bone graft for fracture; *B*, lateral bone graft for a case in which bone has been removed. (Jones.)

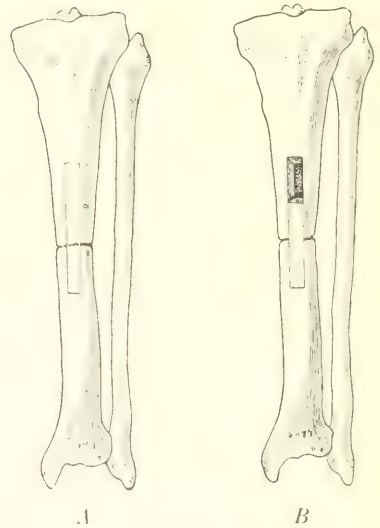


FIG. 148. — Bone grafting. *A*, diagram showing incisions through tibia by twin saw and chisel, detaching a strip above and below the fracture. *B*, second stage of operation. The lower fragment has been removed, and the upper has been pushed down so as to bridge the fracture. (Albee.)

TRANSPLANTATION OF BONE AND BONE GRAFTS. The majority of those who write about war surgery find no necessity for plates, wires, screws, or the bone graft in the early treatment of compound fracture. Now that the Carrel treatment is overcoming infection, and more surgeons understand the principles of extension, alignment and fixation, and the young surgeons on the firing line and at the first dressing stations are no longer removing fragments of bone, good union is being observed more often and the field for bone transplantation after gunshot fractures is getting smaller.

Jones is of the opinion that the graft should contain periosteum, if possible, but periosteum is not essential to the success of the graft. In the bed for the graft, avoid unnecessary blood clot, and provide for adequate blood supply. The graft must rest snugly on the raw surface of bone. The period of fixation after a bone graft must be

maintained longer than after a simple fracture. Here patience is required. If the ordinary time for fracture is eight weeks, it will be sixteen weeks for the graft.

Again and again surgical colleagues have said to me: "I removed the bone plate and in a few weeks union was solid." They attributed non-union to the plate, and the good result to their operation. Had they waited the same length of time, the result would have been the same without an operation.

In regard to grafting after gunshot wounds, Jones states that one should wait until the wound has healed, and preferably some months longer. During this time everything is done to improve the general condition of the patient and the circulation of the limb. Jones remarks

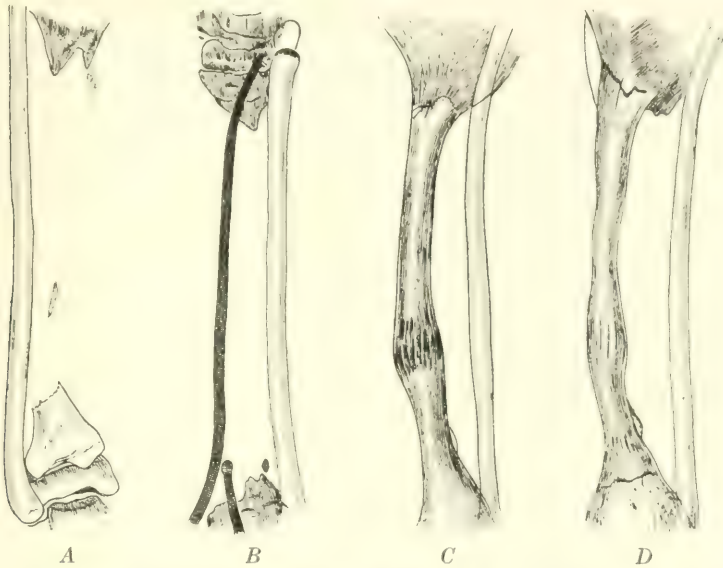


FIG. 149.—A, osteomyelitis of tibia; condition after removal of necrosed bone. B, probe to hold ends of tibia apart during healing of wound. C, fracture of graft; marked callus exudation. D, the fracture of the graft united. (Sketches from diagrams.) (Jones.)

that when this is done first, in many of the cases union takes place, and the surgeon loses the opportunity to transplant.

If this is true, it should be emphasized, because the majority of American surgeons will be glad of an opportunity for experience with bone grafting. This must be discouraged, unless we can prove that the conclusions of this English authority are incorrect.

When, in gunshot fractures, the entire shaft of the bone and the periosteum have been destroyed, either by the original injury, the faulty method of removing all the fragments, or the suppurative process, there is still an opportunity for a successful grafting even in the bed of scar tissue. Experience in time of peace with old cases of osteomyelitis has demonstrated this. Jones reports a case in which the entire

tibial shaft had been destroyed. After the removal of the dead bone and the healing of the wound, a transplant was made from the sound tibia. Seven months later this transplant was fractured. Firm bone union took place in this fracture. The case is illustrated in Fig. 149, *A, B, C, D*.

NERVE SUTURE. In Chapter II of his book, Jones discusses the various methods of nerve suture and tendon transplantation.

In gunshot wounds of the extremities, with or without compound fracture, there is always extensive lesion of the soft parts. The restoration to function of muscle, nerve and tendon injury is apparently a much more difficult problem than restoring the bone to its weight-bearing power. Sometimes the nerve is destroyed beyond all hope of repair, and function must be restored by tendon transplantation. On the other hand, the injury of the nerve may be slight, but the muscle supplied by it partially or completely destroyed. The actual destruction of nerve, tendon and muscle may of itself be slight, but later involvement, due to inflammatory exudate with resultant adhesions, may interfere as much with function as primary tissue destruction. The problem is rarely the simple severing of a nerve, muscle or tendon.

In all of these cases the larger and more difficult orthopedic problem is not so much one of operative technic, as one of non-operative measures which have to be borne in mind and mastered from the onset of the injury. In brief, these are: The proper position of the limb during the healing of the fracture and wound, the constant supervision to prevent paralyzed muscles from overextension, the daily measures for maintaining good circulation and the general condition of the patient.

Prolonged suppuration due to the primary infection of the wound probably has more to do with unfortunate results than any other factor.

Apparently, the Carrel-Dakin method, if instituted early and maintained properly, at once checks this suppurative process, and allows the closure of many wounds within three weeks. Such a result considerably simplifies the orthopedic problem of preserving, or restoring, function.

Many surgeons, in their interest in nerve suture, often overlook that the paralysis is not the fault of the conductivity of the nerve, but of the primary or secondary destruction of the contractile power of the muscle, or the mobility of tendon and joint. In restoring function, one must first ascertain where the chief trouble lies—nerve, muscle, tendon, or joint. One must also consider the effect of scar contraction of the skin. In the healing of a large, granulating surface, nature accomplishes most by contraction and least by epidermization. This contraction can be prevented by Carrel's method of early closure and by early grafting.

Muscles must be freed of all mechanical obstruction before they will respond to nerve stimuli. It is therefore important to prepare the muscles by freeing them of adhesions and improving the circulation before operating upon the nerve, and continue with massage and electricity to maintain muscle function until nerve conductivity is restored.

and to repeat again and again that during this treatment these paralyzed muscles must never be allowed to be overextended.

Conductivity of the nerve can only be restored when the nerve impulses are received by muscle, the circulation of which allows contractility. There must always be some orthopedic apparatus which holds the paralyzed muscle and prevents overstretching. We have discussed this again and again, and Jones mentions it repeatedly in his book.

It would appear necessary to have these rules printed in three colors to hang at the head of the bed of every soldier, so he will know when he is neglected. We must provide for every check. I agree entirely with Jones that in time of peace these orthopedic principles are often neglected, and much of the disability in this war is due to ignorance, or lack of appreciation by surgeons with splendid training in every department except that of orthopedics.

The medical department of our army will not only have to provide for, and train, orthopedic surgeons, but it will have to provide them and general surgeons with all the secondary assistance and apparatus which is required for this orthopedic-mechanical treatment.

The patient himself needs special instruction and daily stimulation in order to get him to practice voluntary use of the muscles which are not paralyzed.

The huge experience with the paralysis of poliomyelitis will be most valuable in the treatment of a larger number of war wounds.

Again we have demonstrated that orthopedic surgery is a first-line problem. Operations upon nerves, tendons, muscles and joints should not be performed until the wound has healed, and until every effort has been made to maintain and restore function by other means. The technic of tendon and nerve transplantation and suture is not different from that employed to restore function in cases of paralysis due to poliomyelitis, but, as Jones points out, the different results have less to do with the technic of the suture and transplantation than with the condition of the tendons, nerves and joints previous to, and after, the operation.

In reviewing the literature of nerve suture and transplantation, as developed by war experience since 1914, and published in *PROGRESSIVE MEDICINE* since 1914, I have been surprised by the almost complete failure to mention this vital part of the orthopedic problem.

DISABILITIES OF THE KNEE-JOINT. For discussion of joint injuries, Jones confines his attention chiefly to the knee-joint in Chapter VI of his book.

The three common conditions are: Simple sprain of the lateral ligament, usually the internal; slipping of the semilunar cartilage; and nipping of the infrapatellar fat.

All of these injuries may be produced by a twist, and after the injury the symptoms may at first be slight. Then there occurs effusion into the joint and recurring disability.

Early recognition and proper treatment will prevent the chronic condition, and the time necessary to cure the recent injury is much less than the chronic.

Sprain of Internal Lateral Ligament. In cases of this kind there is distinct local pain and tenderness over the inner side of the knee and nowhere else. Movement of eversion and external rotation stretches the torn ligament and retards recovery.

The area of the knee-joint should be fixed in adhesive straps, a pad should be placed on the inner side of the heel of the shoe. In severe cases there should be short treatment of rest in bed. As a rule, the former is done and the latter neglected.

Internal Derangements of the Knee. These vary from a slight sprain of the attachment of the internal semilunar cartilage to fractures of the spine of the tibia with rupture of the crucial ligament.

In military practice many soldiers may puzzle the medical officer by complaining of obscure pain and disability in the knee, and Jones states that this has led to a number of operations on normal joints.

In rupture of the internal ligament and damage to the semilunar cartilage there is usually a severe twist of the knee with leg in abduction. In some cases there follows a definite lock of the joint. Soldiers cannot simulate this. In other cases there is no lock, but a click may be heard or felt when the cartilage slips. Swelling of the knee due to distention with effusion is a sign of injury. A definite localized area of tenderness is very suggestive of real trouble. As a rule, the knee cannot be fully extended without pain.

In cases of this kind, there must first be complete rest, with the limb in a splint for ten days. When the patient begins to walk, fixation in bandage or adhesive straps. This protection in the after-treatment is essential. If it is not followed out, the effusion and pain recur. With each recurrence precious time is lost, and the difficulty of a permanent cure increased.

When there has been bad after-treatment with repeated stretching and effusion, a thickened scar develops about the semilunar cartilage. The scar is tender and in some cases may be felt. It is always on the inner, slightly anterior portion of the knee-joint, well to the inner side of the ligamentum patellæ. The scar thickening may be sufficiently great to be pinched when the leg is extended. This will increase the pain and tenderness.

In the less severe cases, when there is simply a sense of insecurity and a click, there must first be a primary period of rest, followed by massage and graduated exercises, the joint being supported by a bandage or adhesive straps.

In more severe cases when the scar tissue is large enough to be nipped in extension, an operation is indicated, at which time the entire joint is inspected and the scar tissue at least excised.

When there is definite locking of the joint this means a displaced cartilage. When active and passive motion of the knee-joint are restricted in addition to the recurrent locking, we know the loose cartilage has not been reduced.

In the primary treatment of displaced cartilage, reduction is first attempted. The patient should lie on his back with the thigh flexed on the body and leg on the thigh. In this position one often palpates

the fulness on the inner side of the joint over the tibia. The patient is then told to make a sudden kick at "three" as the surgeon counts: one, two, three. Simultaneously with the kick at "three," the surgeon rotates the foot inward and pulls with pressure on the thigh.

The patient knows that reduction has been accomplished, because he will be able to fully extend the knee. If one cannot get the help of the patient, make the same manipulation under ether. Reduction having been accomplished, the joint is fixed in extension in a padded splint. The splint should remain on at least ten days, then should begin the after-treatment of massage and moderate exercise, and the joint protected by a bandage or adhesive straps.

When these cases are seen early and reduction is accomplished, the result is usually successful after the simple treatment outlined.

In late cases there is usually fluid, the patients are comfortable at rest, but symptoms return after exercise. Even in late cases, after a few weeks, reduction may be possible. It is always worth while trying. If reduction now fails under anesthesia, operation is indicated.

Beware of the cases in which you think you have reduced, but in which the patient still complains of a feeling of insecurity. This residual symptom may be due to adhesions. Here passive motion under gas anesthesia usually completes the cure.

We are all familiar with Jones's method of opening the knee-joint with the leg flexed over the end of the table, as shown in Fig. 150. There is no necessity to speak of the aseptic technic. The joint being opened, one takes a blunt hook and slips it under the free margin of the cartilage. This allows perfect inspection. In removing the cartilage, leave no tags of cartilage, look for fringes or villi, and remove them, if present.

I cannot agree with Jones that operations of this kind should not be done at the base hospitals at the front. I am confident that the technic there will be as good as at home.

I cannot agree with him that any environment is a source of danger to an experienced surgeon, because he can control the environment. I cannot agree with Jones that movement of the knee-joint during the arthrotomy is a risk, because air enters the joint. I have been opening joints for twenty-five years, and have paid no attention to the entrance of air. Now and then manipulation is helpful to inspect the joint and get out all the tags.

Operative cases must have the same careful after-treatment. Never neglect massage to the quadriceps muscles. There is no reason why these cases should not be returned to active duty.

Recurrent Effusion. When this takes place it is a definite indication that the conservative or operative treatment has not accomplished a perfect result, which is generally due to faulty after-treatment or secondary injury, or, in an operative case, to leaving behind a tag of cartilage, or a fringe of synovial membrane.

Rupture of Crucial Ligaments. This is one of the graver lesions of the knee-joint. When recognized and properly treated in the early stage, good results are accomplished. Increased movability of the

knee-joint, with ability to dislocate the tibia, even slightly, is a pretty definite sign of a torn crucial ligament. Cases of this kind require a long fixation, knee extended, in plaster or a Thomas splint. Later, the patient is allowed to walk in this splint. Operation is contra-indicated.

Fracture of the Spine of the Tibia. According to Jones, in some cases the dislocated fragment of bone may lodge in front of the knee-joint and prevent full extension.

The characteristic symptom is a somewhat rigid block to full extension accompanied by pain referred behind the patella. When the fragment is not dislocated, or can be reduced, fix the knee in full extension for a period sufficiently long to allow healing. When this cannot be done, remove the fragment of bone, and then put the knee up in the same dressing. Jones prefers to explore the joint in a case of this kind by a longitudinal incision, splitting the tibia longitudinally, but he remarks that this is needed only in exceptional cases (Fig. 151).

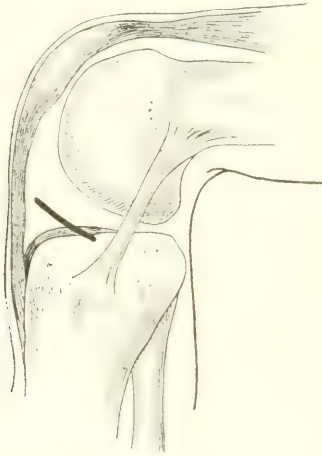


FIG. 150.—Showing position of incision. (Jones.)

Retropatellar Pads of Fat. After all injuries of joints there is apt to be increased vascularity of the synovial membrane and the fat beneath. With motion of the joint, pieces of the membrane and fat may be nipped and pulled out into villi or papillomas. This is the most common cause of a single joint lesion in civil life. We may expect to see it in soldiers because of the possibility of repeated injury to the knee-joint. The patient usually complains of pain and tenderness during walking, which is especially marked in going up and down stairs and in rising suddenly from a sitting position.

The first treatment in the simpler cases is to protect the patient from further strain on the knee-joint. Place a cork pad half an inch thick inside the boot under the heel. This will prevent complete extension of the knee. Place about the knee-joint a cage support as shown in Figs. 152 and 153. This limits extension, but allows full flexion. As a rule, treatment of this kind accomplishes results within a few weeks.

Always recollect the quadriceps muscle; its tone must be improved or maintained by massage and voluntary contraction.

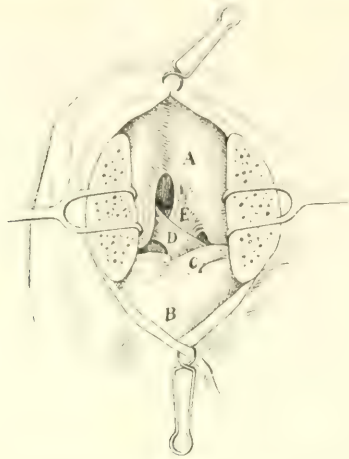


FIG. 151.—Showing patella split. *A*, femur; *B*, tibia; *C*, transverse ligament; *D*, anterior crucial ligament; *E*, posterior crucial ligament; *F*, cut halves of patella. (Jones.)

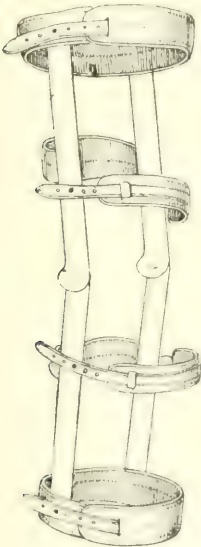


FIG. 152.—Cage support for knee. (Jones.)

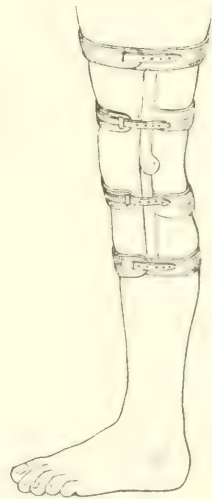


FIG. 153.—Cage support for knee applied. (Jones.)

All the principles of after-treatment mentioned by Jones in this chapter should be followed out in the graver injuries of the knee-joint by gunshot after the primary treatment has accomplished the healing of the wound and the patient is ready to walk.

Surgeons in this war will have to develop an orthopedic sense.

THE SOLDIER'S FOOT. From conversations with officers of the Medical Department of the Army, I get the impression that there is considerable disagreement with the statements made by Colonel Jones in Chapter III of his book. However, we must bear in mind that this was written by one of the foremost living orthopedic authorities, and since the beginning of the war the British Medical Department has given Colonel Jones every opportunity to observe and treat the orthopedic cases arising in the British Army. I trust to be able in this review to present the criticisms of our medical officers and of the civilian orthopedic committee who are investigating this problem.

Anatomical. Jones describes the foot as consisting of two parts: The hindpart formed by the os calcis and astragalus, posterior to the midtarsal joint, and the forepart consisting of the rest of the tarsus, metatarsus and toes.

The arch of the hindpart (os calcis and astragalus) bears the weight of the body when the individual stands. The arch of the forepart is more mobile, and gives spring to the foot when walking. This spring depends upon the integrity of the small muscles of the foot and the longitudinal and transverse arches, and one other very important factor: freedom of the movement of the toes themselves. A tight shoe, therefore, compressing the toes interferes with this factor.

Deformities and Disabilities. It has just been noted that the freedom of the movement of the toes is one of the basic parts of the forepart of the foot. For this reason hallux rigidus and valgus and hammer-toe are usually associated with flat-foot. With metatarsalgia there is often impairment of the transverse arch; impairment of the longitudinal arch accompanies various degrees of weak, everted and flat-foot. The disabilities, therefore, chiefly concern the mobile forepart of the foot. The lesions which are associated with disabilities of the hindpart are less frequent, for example, periostitis of the os calcis, strain of the insertion of the tendo Achillis.

In the several disabilities of the foot, there may be more than one factor.

Flat-foot. This term covers all degrees of strain of the longitudinal arch, a part of the forefoot. The degree varies from a slight strain to complete descent of the arch, with bone deformity.

The essential feature of flat-foot is abduction and eversion of the forepart (Fig. 154).

Flat-foot may begin as an acute condition. If the arch is high, the pain is more acute. The locality of the pain changes as the arch distends.

Acute Flat-foot. The pain may be so severe that the patient cannot walk. The attack may begin when the patient begins to walk after a long period in bed from acute rheumatism, or when the patient is suddenly called upon to be on his feet for a long interval. This type may be frequently observed in younger people, especially if their shoes are tight and there is no room for the movement of the toes.

There is no difficulty whatever in recognizing an acute flat-foot. A few weeks ago one of my residents at St. Agnes's Hospital was taken suddenly with intense pain at the junction of the middle and outer

third of the foot, on the inner side. He had been standing all day in the operating room. The x-ray showed separation of the bones in this position. Relief was given by imbricated adhesive straps.

In very acute cases, Jones is of the opinion that the patient should go to bed, receive daily massage until the tenderness has passed off, and during this time bear no weight of the body. Then the foot must be abducted and inverted, and held in this corrected position by plaster of Paris for ten days. Then the plaster is removed, and is followed by a few days of massage, exercise, movement of the toes and inversion, but never eversion. Then the patient walks in a specially constructed shoe. This shoe is very roomy in the forepart to allow free play of the muscles and toes. It grips the ankle and heel snugly.



FIG. 154.—Flat, everted foot. (Jones.)

It is my impression that the Munson shoe, with which our army is provided, has these features. I have just worn a pair for ten days with great comfort.

All will agree with Jones that shoes with pointed toes are harmful.

According to Jones, the inner side of the boot or shoe should be straight—a condition not found in the usual footwear, and apparently not present in the British army boot, because Jones comments that it is not yet perfect. I get the impression that our army shoe will meet the requirements.

If the officers get their boots for appearances and not from the quartermaster's department, we may be able to demonstrate the difference between the shoe made for the army and that purchased from outside dealers.

According to Jones, after getting the proper boot for the patient recovering from acute flat-foot, it should have some special attachments. The heels should be "crooked," that is the inner side of the heel is made one-third of an inch higher, tapering gradually to the outer side. This, of course, produces inversion of the foot, that is, it corrects the deformity eversion (see Fig. 154). The heel should be lengthened forward three-quarters of an inch on the inner side and the sole should be raised one-third of an inch by a patch on the inner side of the sole, just below the toe-joint (Fig. 145, *B*). The patient must be cautioned never to bear weight without his shoes on. The man must walk with the feet parallel; there must be daily graduated exercises. It may require six weeks to two months to completely cure an acute flat-foot.

Colonel Jones remarks that perhaps it would be better that the boots of all the soldiers who are subjected to long marches and weight-carrying should have this special shape and additions. All recruits with any signs or symptoms of weak feet should start their training with this orthopedic shoe.

It is to be recollected that an acute flat-foot may follow a sprain of the ankle or any injury which tears or strains the ligaments of the foot. In gonorrheal periarthrititis, the ligaments are soft from the exudate and stretch. If the patient is allowed to walk without protection of a boot or a bandage, flat-foot is very apt to develop.

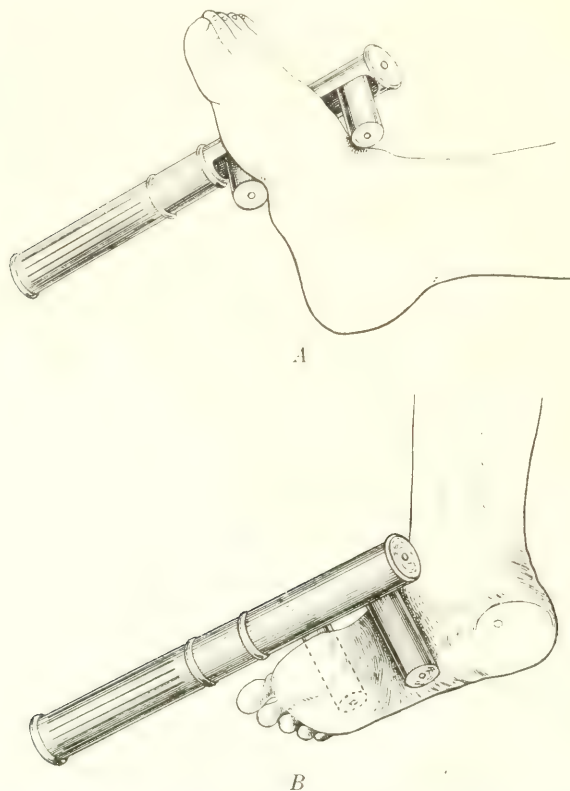


FIG. 155.—A, flat-foot, first stage: Thomas wrench applied to invert. B, flat-foot, second stage: Thomas wrench applied to adduct foot at midtarsal joints. (Jones.)

Rigid Flat-foot. When the recognition of the acute flat-foot is delayed, or no treatment instituted, the flat-foot may become rigid in its position of deformity. In cases of this kind, forcible manipulation with overcorrection should be the first part of the treatment. This method is shown in Fig. 155, A and B. After correction, plaster-of-Paris splints, then two or three weeks' rest, then the usual after-treatment with exercise and the adjustment of a proper boot. In extreme cases of this kind, it may be necessary to place in the boot an outside

iron splint to maintain the foot in its correct position, as illustrated in Fig. 156.

When the rigid flat-foot is neglected for years, osseous flat-foot develops. The bones are changed in shape as they adapt themselves to the new position of deformity. Feet of this kind cannot be corrected sufficiently well to allow the individual to become a soldier, but it is sometimes difficult to differentiate between the rigid and the osseous flat-foot.

Flat-foot Due to Spasm of the Peronei. The condition is shown in Fig. 157. It is not an uncommon finding, if one knows how to diagnose it. Jones has operated on as many as 150 cases a year. This type of

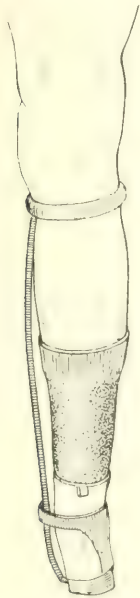


FIG. 156.—Outside iron in addition to crooked long heel and piece to sole. (Jones.)



FIG. 157.—Peroneal spasm producing a flat, everted foot. (Jones.)

flat-foot is observed, as a rule, among robust individuals shortly after puberty. Usually, there is a history of an injury which produced no disability at first. The patient limps, with a springless gait, with rigid feet, and toes pointing out. The feet are everted. The area over the scaphoid is thickened. On superficial examination, the first impression is that of an osseous flat-foot. The pain is sometimes acute, the feet may perspire. As a rule, the individual cannot walk far. Removal of the boot gives temporary comfort. The individual is unable to invert the foot and when he attempts this, the peronei muscles become rigid. On examination, there is a tender area over the scaphoid and where the external malleolus impinges on the os calcis. There is also tenderness over the peronei. At examination, attempts to invert give pain, and the peronei muscles are thrown into contraction. If the patient's

attention is diverted and these muscles are found to be relaxed, it is possible to make a forcible inversion. The character of the condition immediately changes, and there are now no longer the signs of a rigid or osseous foot. The moment the surgeon releases his hold, the deformity and rigidity return.

According to Jones, operation is indicated. The peronei are exposed, Fig. 158, and, from each, about three-quarters of an inch are excised, beginning one and one-half inches above the malleolus. The foot is then fixed for three weeks in an overcorrected position of inversion and adduction. Then follows the ordinary after-treatment.

Personally, I have never seen or recognized a case of this kind. It would be interesting to know how often it is recognized in this country among our own troops.



FIG. 158.—Exposure of tendons of peronei preparatory to excision of about $\frac{3}{4}$ inches. (Jones.)

Diagnosis of Flat-foot. According to Jones, the differential diagnosis between the different types requires more than ordinary experience and training. The osseous flat-foot is usually strong and painless. In the rigid flat-foot, pain is observed after unusual exercise. The recognition of the type due to contraction of the peronei has just been described.

It is important to note that in the osseous flat-foot, in which the foot has accommodated itself to the new position, the men may be able to bear the strain of long marches. In cases of this kind, as the deformity is so marked, the recruit is apt to be rejected. It is important also to note that the majority of flat-feet can be corrected by mechanical or operative means.

From Jones's description, I am confident, more cases of flat-foot may be seen after, rather than before, enlistment, especially in individuals who, before entering the army, have not walked much. For this reason, in the training camps there may be a large opportunity to recognize and treat flat-foot in the stage in which treatment gives the best results. If this does not prove to be true, it will indicate that the United States army shoe is a good preventive of flat-foot.

In regard to special exercise, Jones remarks that this method, although excellent, will not cure a case of flat-foot, except in conjunction with the details of treatment already outlined.

Claw-foot. Jones calls attention to the large number of soldiers with claw-feet, who have passed the various examining boards, and even find their way to the front. These patients, according to Jones, are unfit for military service, and should never be accepted as recruits.

Claw-foot begins in early life, but, as a rule, is not recognized until a later stage of development. The causes are not as yet cleared up. According to Jones, it passes from one stage to another, and these can be divided into five. The condition may spontaneously arrest itself in any of the stages. The time of development varies. In childhood, there is no marked deformity, but the child is clumsy and frequently stumbles without cause. If one examines the foot at this period in the first stage, it will be found that the foot cannot be dorsiflexed beyond a right angle with the leg, due to the contraction of the tendo Achillis



FIG. 159.—Claw-foot, second degree. (Jones.)

and the structures of the sole of the foot. This explains the stumbling, as the child is unable to properly flex the forepart of the foot, and when he runs he trips on his toes.

In this first stage one must stretch the contracted tendo Achillis and plantar structures by manipulation or tenotomy, or lengthening of the tendon. Then there should be overcorrection, temporary bandage, and, later, a shoe.

In the *second* degree of claw-foot (Fig. 159) the deformity is so marked that it is easily recognized: The forepart of the foot drops, due to flexion

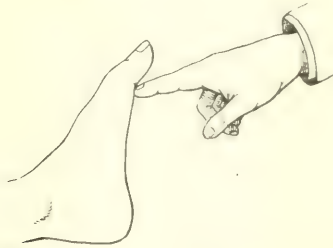


FIG. 160.—Claw-foot, second degree. The surgeon's finger easily replaces the dropped head of the metatarsal bone of the great toe; a case in this stage is suitable for tendon transplantation. (Jones.)

at the midtarsal joint and exaggeration of the arch. The great toe is dorsiflexed at the metatarsophalangeal joint, and the tendon of the extensor proprius hallucis is prominent. When the surgeon places a finger under the ball of the great toe, the toe lifts easily and automatically straightens out (Fig. 160). In this stage the other toes do not present this deformity, but there is a shortening of the tendo Achillis.

In this second stage in the young there is no pain and only the disabilities already mentioned—clumsiness and tripping. In older individuals long marching produces pain and fatigue, and often the individual sol-

dier is thought to be a malingerer, because the usual deformity of a flat-foot is absent. There is no fall in the arch, but a careful examination will find tenderness in the area of the metatarsophalangeal joints.

The treatment of the second stage of claw-foot is operative, and if the individual is a soldier, he will be able to return to duty in a few weeks. In this operation the plantar fascia is divided and stretched; the tendon of the extensor of the great toe is severed from its attachment; two holes are drilled close to each other behind the metatarsal head. Through this tunnel the tendon is drawn by a catgut ligature (Fig. 161); pulling this tendon raises the metatarsal head into its proper position (Fig. 162), and then the lower end of the tendon is stitched to the upper part just above its entrance into the bone tunnel (Fig. 163).

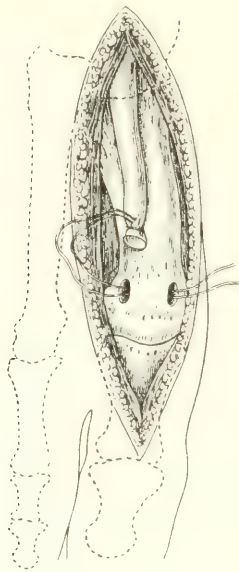


FIG. 161.—Claw-foot, second degree. Operation by transplantation of tendon of the extensor of the great toe. The diagram shows how the tendon of the extensor proprius hallucis is introduced through the tunnel above the head of the metatarsal bone. (Jones.)

The wound is closed, the foot bandaged on a padded metal sole plate. This plate is placed transversely behind the head of the metatarsal, in order to flatten the arch of the foot. The whole foot is fixed in a rectangular foot splint bent at an angle less than the right. After the healing of the wound and the removal of the stitches, the foot is fixed in its corrected position in plaster. The patient walks in from three to six weeks.

He should wear a boot with low heels and a bar across the sole beneath the head of the metatarsal bones. Keep the foot dorsiflexed when walking.

In the *third* degree of claw-foot, the deformity of Fig. 159 is much more marked, as shown in Fig. 164. It is no longer possible to lift the

great toe, as shown in Fig. 160, because of the increased contraction of the plantar tissues. In this third degree, the other toes have the characteristic dorsiflexed deformity present in the second degree in the great toe only (Fig. 159); in addition, the movements of all the



FIG. 162.—Claw-foot, second degree. Operation showing the tendon of the extensor proprius hallucis passed through the head of the metatarsal bone of the great toe and pulled before fixing. (Jones.)

toes are limited. There is some rigidity. Corns form on the ball of the foot, because the patient has difficulty in getting the heel to the ground. The contraction of the tendo Achillis is much more marked than in the first two stages.

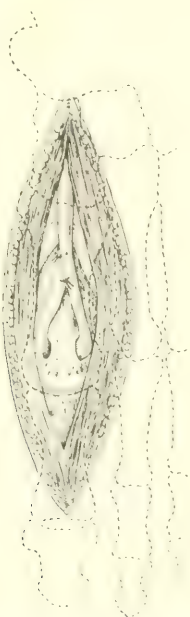


FIG. 163.—Claw-foot. Operation for second degree, showing how the tendon of the extensor proprius hallucis, after traversing the tunnel in the bone is attached to itself and secured. (Jones.)

In this third degree of claw-foot, the operation is in two stages: First divide and stretch the plantar fascia, breaking the arch toward the condition of flat-foot. As the metatarsal bones are obliquely placed, make separate incisions on the dorsum of the foot half to one inch over the shaft of first to fourth metatarsal bones without opening the joints.

Remove a piece of bone from each shaft of one-half to one inch. Leave the heads of the bone alone. Leave the fifth metatarsal intact to act as a splint. In the second stage of the operation, the tendo Achillis is divided and the foot wrenched into dorsiflexion. Then follows the same dressing and after-treatment as in the second stage of the deformity.

In the *fourth* stage of claw-foot there develops, in addition to the deformity already described, a marked varus (Fig. 165). The corns



FIG. 164.—Claw-foot, third degree. (Jones.)



FIG. 165.—Claw-foot, fourth degree. (Jones.)

are more numerous and tender. Walking is painful and difficult. The treatment is more extensive than for the third degree. All contractions must be cut or stretched. Flexor and extensor tendons must be cut. The astragalus must be removed. Now the foot can be molded into a shape which will carry the weight and allow walking with comfort.

In the *fifth* degree of claw-foot (Fig. 166), the deformity is still more marked, and the development of an equinovarus position. The con-



FIG. 166.—Claw-foot, fifth degree. (Jones.)

tracted toes are cyanotic. The patients beg for amputation. Jones recommends the following operation: Remove the astragalus; make a flap incision on the sole of the foot at the base of the toes and a similar flap on the dorsum of the foot; then remove the toes with the heads of the metatarsal bones; the results of this amputation is shown in Figs. 167 and 168.

Individuals with the second degree of flat-foot, when corrected, will make good soldiers, but probably not in the third, fourth and fifth degree. However, the operative treatment in these latter three stages

will make them more useful citizens, and probably relieve non-defective men for the army.

The probabilities are that the recruit with hallux rigidus, valgus or metatarsalgia will not be accepted. Nevertheless, they may slip through, and these conditions can be corrected. Many individuals in time of peace have decreased efficiency on account of these correctable deformities, and in this country we should bear in mind that there are many existing deformities which, if properly corrected, would increase the number and efficiency of the men at home, and so relieve more fit men for the front.

This is one of the larger problems of preparedness, and involves the tapping of the latent powers of the country.

In hallux rigidus, valgus and metatarsalgia there is often an associated flat-foot. In these conditions there are some features in common. Mild cases may be relieved by a proper boot. In cases requiring operation, there is a common after-treatment and corrected shoe.



FIG. 167.—Claw-foot, fifth degree. Front view after operation recommended in the text. The toes and the heads of the metatarsal bones, as well as the astragalus have been removed. (Jones.)



FIG. 168.—Claw-foot, fifth degree. Side view after same operation. (Jones.)

Mobility of the Toes. Apparently, Jones thinks it is important here to discuss the importance of the correct position and free mobility of the great toe in marching, and to describe the marching boot. Racers who go barefoot preserve the position of the great toe in adult life. In young children the great toe is directed slightly inward to the median line of the body, in line with the anterior part of the inner longitudinal arch of the foot. In racers who wear boots, the toes are cramped, the small muscles of the foot atrophy from disuse. The position of the great toe changes, and its power to spread inward is impaired. In a strong adult foot, not deformed by wearing a pointed boot, the great toe spreads inward by the action of the abductor hallucis.

Good Marching Boot. This boot should have room to allow the anterior part of the foot and toe to alter their position for the changes in balance and strain. The boot should fit comfortably and closely about the heel and ankle, so that in walking the heel does not move

in the boot, chafe and form a blister. I can say of our army shoe that it meets these conditions.

Jones is of the opinion that the marching boot should be adjusted to prevent flat-foot by raising the inner side of the heel, and not the outer side (Fig. 145). The inner side of the boot should be straight up to the tip of the big toe, so that the two boots are parallel. Pointed toes should not be allowed.

The sole of the boot inside should be as broad as the foot when spread by the weight of the body and any additional weight the individual is to carry. When one fits a soldier for his shoes, he should be dressed and equipped for full marching orders.

The upper boot should not compress the forepart of the foot. The toe cap should be stiff and deep enough to allow free movement of the toes. The stiffening should extend back on the inner side of the boot to a point behind the metatarsophalangeal joint of the great toe.

The boot should be long enough to allow the foot not only full lateral play, but full length when the soldier is carrying his heaviest pack.

Corns do not develop in a boot of this kind.

In Colonel Goodwin's article, he speaks of a regimental chiropodist, an enlisted man with three weeks' training, who helps the soldiers take care of their feet.

According to Jones, the appointment of a regimental "corn and callous" attendant is a confession that the men are not properly fitted, or that the shoes are not properly made. If possible, new shoes should be fitted to soldiers after they return from a long march with swollen feet. Remember, it is the forepart of the foot that swells, and not the hindpart.

According to Jones, the present British army boot is an improvement, but is still lacking in two points—the straight inner side and the clear stiffened arch in the upper of the forepart.

I shall discuss Munson's article on our army shoe, and I think I shall be able to demonstrate that our boot is an improvement on the British. I get the impression, if there is much foot trouble, that it will be among the officers who, for one reason or another, have not purchased the army boot, and, if vanity has been one of their reasons, they will probably later suffer for it.

Hallux Rigidus. In this condition there is limitation of power to dorsiflex the great toe at the joint between the phalanx and the metatarsal, a lesion somewhat similar to the second degree of claw-foot, except the toe is in a position of extension (Fig. 169). This deformity leads to strain of the joint on long marches, followed by signs of inflammation in the region of the joint.

In early cases before bone changes, the patient should wear a special boot (Fig. 170); a bar one-third inch thick and one inch broad is fixed to the sole of the boot behind the head of the metatarsal bone. When the tenderness has disappeared and power of dorsal flexion has returned, begin massage and hot and cold baths.

In more advanced cases there are osseous changes, and the condition gets progressively worse. Relief is given by an operation similar to that which will be described for hallux valgus.

Hallux Valgus. The deformity is typical (Fig. 171). There is usually a bursa or a bunion, and varying degrees of periarthrititis and arthritis up to infection with sinuses.

The degree of deformity is not an index of disability. Some soldiers with marked deformities are not incapacitated. The disability is due chiefly to inflammatory processes in the bursa, in the joint, and to the pressure on nerves by the inflammatory exudate.



FIG. 169.—Hallux rigidus. (Jones.)

In mild cases, a shoe recommended for hallux rigidus (Fig. 170) should be tried. The forepart of the boot must be roomy, and the bunion should be protected with a piece of felt with a hole in the center.

In the majority of cases, operation gives the best results. There should first be a preliminary rest-treatment until the inflammation subsides.

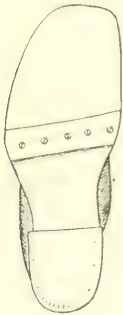


FIG. 170.—Bar on sole of boot behind the heads of the metatarsal bones. (Jones.)



FIG. 171.—Hallux valgus. (Jones.)

Jones condemns transplantation of the extensor proprius hallucis tendon to the inner side of the metatarsal head. He also condemns excision of the joint.

In early cases, Jones recommends a linear or cuneiform osteotomy of the metatarsal bone (Fig. 172). In addition, tenotomy of the extensor proprius hallucis. In more advanced cases the bony exostosis must be excised, and some operation for pseudarthrosis done.

The operation preferred by Jones is resection of the head of the metatarsal (Fig. 173) with the bony excrescences, and then using the bursal flap to cover the bone. He uses only one wall of the bursa. When the whole bursa is employed, some cases develop bursitis. Fig. 174

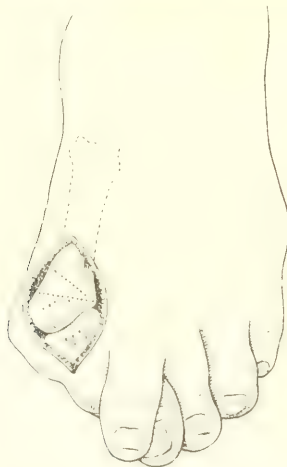


FIG. 172.—Hallux valgus. To illustrate osteotomy of the neck of the metatarsal bone, showing the wedge to be removed. (Jones.)

shows the bursal flap. In all cases the extensor proprius hallucis is divided, but not transplanted. It seems best to preserve the sesamoid bone. Fig. 175 illustrates the splint he employs in the first dressing. At the end of three weeks the patient is given a proper boot. This is made of soft material, with a stiff leather sole. On the sole there should be a leather bar one-half inch thick and one inch wide behind the head

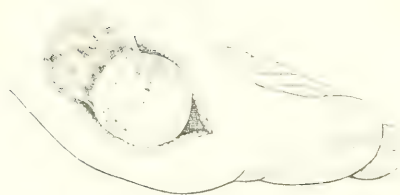


FIG. 173.—Hallux valgus. To illustrate resection of head of the metatarsal bone by oblique incision through the bone. (Jones.)



FIG. 174.—Hallux valgus. Showing flap to cover the end of the metatarsal bone in the operation illustrated in Fig. 173. (Jones.)

of the metatarsal bone. The heel should be one-third inch higher on the inner side (Fig. 144)—the usual boot for flat-foot. Later, the ordinary boot may be altered in the same way. The patient should never be allowed to get up and walk in a slipper.

The operation described by Jones for hallux valgus and bunion should be compared with my illustrated critical review in *PROGRESSIVE MEDICINE*, for December, 1912 (p. 299, Figs. 50 to 55). I am inclined to think that patients properly operated on for bunion and hallux valgus will make good soldiers.



FIG. 175.—Splint for hallux valgus after operation. (Jones.)



FIG. 176.—Hammer-toe. (Jones.)



FIG. 177.—The disability produced by amputation of second toe. (Jones.)

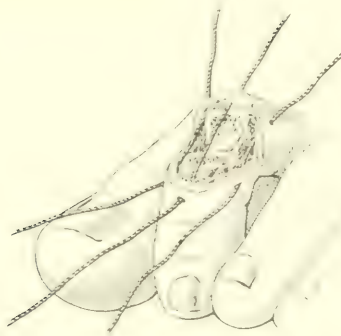


FIG. 178.—Wedge exsection of joint for hammer-toe. (Jones.)

Hammer-toe. This deformity usually affects the second toe. The deformity in slight degrees may be present in other toes. It is shown in Fig. 176. It is associated with painful corns, and the individual is unfit for marching. The deformity may be congenital, but is more often due to badly fitting shoes. It may be associated with hallux valgus.

In the treatment, amputation should never be done, as it may lead to a disability more serious than the original one—hallux valgus (Fig. 177). Jones advises a wedge-shaped excision of the articular cartilage of both bones of the joint, correcting the deformity and leaving the toe in extension, with this joint ankylosed. The corn should be excised with a wedge-shaped piece of skin (Fig. 178). Divide the flexor tendon, suture the skin incision for a linear scar, fix the toe in a splint illustrated in Fig. 179, *A*, *B* and *C*.

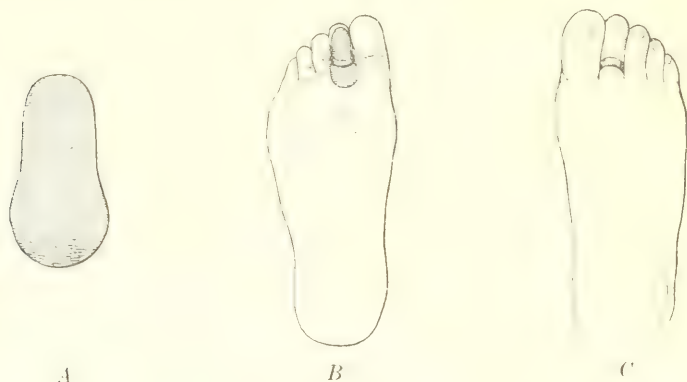


FIG. 179.—*A*, splint for hammer-toe; *B*, splint for hammer-toe applied, view from sole of foot; *C*, splint for hammer-toe applied, view from upper side of foot. (Jones.)

Displacement of the Little Toe. The deformity is similar to hallux valgus—congenital, or due to tight boots. The toe is painful from pressure. It interferes with marching. The best treatment is amputation of the toe, with a good skin flap. Protect the area from pressure until there is firm healing. If there are any exostoses on the head of the metatarsal, remove them, but do not remove the head of the bone, as it weakens the arch of the foot.

Metatarsalgia. This is usually associated with flattening of the transverse arch. Pain and tenderness are located in the fourth metatarsophalangeal joint, in the third, and less frequently in the second. The pain may come on suddenly and produce complete disability. The boot already described (Fig. 170) often relieves the pressure from the head of the metatarsal bone and accomplishes a cure. The inner side of the heel should be raised as in the boot for ordinary flat-foot. Sometimes a band around the base of the metatarsals prevents spreading. There should be exercise and massage. The patient should never wear anything but an orthopedic shoe. In more severe cases, especially in soldiers, remove the head of the metatarsal bone through a small dorsal incision and give the patient the special boot already described.

Injuries and Strains of the Tendo Achillis. This is one of the causes of the so-called painful heel. It may be a synovitis, a bursitis, or a periostitis at the insertion of the tendon. In synovitis there is effusion into the tendon sheath and visible swelling. Rest and bandaging should be the first treatment. Then moderate exercise with the heel of the

boot raised three-quarters of an inch to relax the tendon. In bursitis, the bursa under the insertion of the tendon on the os calcis is involved. The swelling is less than in synovitis, more localized and often one gets fluctuation. Strap the leg above the malleoli, raise the heel of the boot; insist upon moderate walking. In periostitis there is no swelling, but localized tenderness. The treatment is the same as for bursitis. When the bursitis is not cured, puncture the bursa with a hot needle. When one can palpate irregular fibrous masses in the tendon, they should be excised.

Os Calcis Spurs. This is another cause of painful heel. They may give no discomfort until the patient sprains the ankle or contuses the os calcis. The spurs show in the x-ray. The best treatment is to excise the spurs, with the surrounding scar tissue and periosteum. Do not make the incision through the sole.

Ostitis and Periostitis. This is another cause of painful heel. It may follow contusion or partial fracture. Treatment is often unsatisfactory as in compression fracture of the astragalus, and os calcis. The bony masses should be excised, but the results, as a rule, are not sufficiently good to allow an individual to become a soldier.

The importance of orthopedics in the present war is so great that I felt justified in reviewing this book by one of the greatest authorities in detail.

Plaster of Paris. Osgood¹ found plaster-of-Paris dressings best, and employs bridges to span the open wound. I have fully discussed his methods with illustrations in *PROGRESSIVE MEDICINE* (December, 1915, p. 292, Figs. 50 to 69).

Colonel Jones, whose book I have reviewed here, objects to plaster.

LITERATURE ON MILITARY ORTHOPEDICS. Having reviewed Colonel Jones's book, it will be interesting to give a brief survey of other contributions. Space prevents any detail.

E. W. Fisk² emphasizes the value of orthopedic surgery in the present war. As preventive measures, he lays stress on apparatus, massage and manipulation. It is his opinion that ankylosis in injured and septic joints can frequently be prevented by early systematic manipulation. When ankylosis cannot be prevented, the limb must be immobilized in the most favorable position—a point also emphasized by Jones.

Contraction deformities must be prevented by the early application of splints—a point that has been emphasized again and again in *PROGRESSIVE MEDICINE*.

Deformities due to paralysis of groups of muscles require over-correcting apparatus, also emphasized by Jones.

Fiske is of the opinion that plaster of Paris makes the most efficient splint.

In open infected wounds the proper immobilization of the limb is second in importance, and, third should be constant attention to alignment and position for future function. As long as the callus is soft and

¹ *Journal of the American Medical Association*, 1917, lxxvii, 418.

² *Military Surgeon*, 1916, xxxix, 497; *Surgery, Gynecology and Obstetrics*, 1917, xxiv, Abstr. 383.

joint adhesions pliable, reposition to corrected position is possible without operation.

Robert B. Osgood's¹ contribution is entitled *Orthopedic Surgery in War Times*. It is to be remembered that this paper was delivered in June, 1916, over one year ago. In *PROGRESSIVE MEDICINE* for December, 1915 (p. 293), I reproduced Osgood's collection of photographs of various splints due to his experience in the American Ambulance in Paris.

In 1916 Osgood wrote: "Each must strive for the complete recovery of its wounded, in order that the ranks may be kept as full as possible. Next in importance, those who recover from mutilating wounds must be so reconstructed and reëducated that they will not become a burden on the industrial community."

Osgood describes orthopedic surgery in war times under three headings: The physical examination of the recruit; conserving and restoring function of the wounded part; and reëducation of war cripples.

In the examination of the recruit, he emphasizes first feet and shoes. He calls attention that during the battle of the Marne almost 25 per cent. of the unwounded were rendered less efficient by becoming foot-sore. Jones calls attention to the fact that the British shoe is not up to his requirements. Osgood is of the opinion that the American shoe is better. He found great difficulty in picking out satisfactory shoes in France, and, as a rule, when he found the right one, it was of American make. Foot trouble was very common with French soldiers.

I know that Colonel Munson and the Orthopedic Department of the Surgeon-General's Office under Major Brackett are making every effort to prevent foot affections among American soldiers. My associate, Captain Nichols, of the M. R. C., surgeon at Fort Howard near Baltimore, told me that the copy of Colonel Jones's book which I sent him had been the greatest help to him in the recognition and proper treatment of different forms of painful and weak feet among the recruits. It gave him the information he required. Apparently, he had not yet received the special circular on the care of the feet issued by the Surgeon-General's Office.

Osgood wrote: "The opportunities for preventive orthopedic surgery have not ceased when the base hospital is reached." This is a very interesting statement for 1916, because one of Osgood's colleagues who went to France in the past few months had the impression that orthopedic surgery was a third-line and not a first-line problem.

Osgood emphasizes the delayed healing due to infection of the wound. During this period there is danger of soft-part contraction, nerve involvement, adhesion of tendons, ankylosis of joints, angular deformity and non-union of bone. He calls attention to the wonderful work of Robert Jones.

Osgood favors plaster of Paris, differing, therefore, from Jones, but he calls attention to the ingenious splints of Colonel Jones, Joseph Blake of the American Ambulance, the overhead suspension, or the so-called

¹ Journal of the American Medical Association, 1917, lxvii, 418.

Balkan splint, and the various combinations of metal splints which are comfortable, efficient, and allow rapid and easy access to the wound.

In regard to restoration of function, Osgood was tremendously impressed with the power of repair in the bone in open fractures and the resistance of the synovial membrane to infection.

He calls attention to the difficulty of deciding what is best to do for an infected joint. He would prefer, first, when in doubt, to make a small incision, wash out the joint, and leave a tiny rubber-tissue drain. Large multiple incisions and very free drainage make restoration of joint function more difficult, and it is a question, in this group, whether early excision should not be done.

This is one of the most difficult problems in peace surgery, and, from the teaching of Halsted, I agree with Osgood that it is best to try the simpler method first. Halsted years ago demonstrated the danger of gauze drains in a joint, and the better results from rubber-tissue drains, or no drain at all—simply an open arthrotomy with irrigation. But in this war we are dealing with a more extensive joint wound, and, as a rule, a more intensive bacterial infection. (See *PROGRESSIVE MEDICINE*, December, 1899, p. 197; 1900, p. 170). I get the impression that the Carrel method of draining and irrigating may be required to get the best results and best ultimate function.

Osgood emphasizes the importance of early massage and passive motion. Passive motion should be gentle and with force, and there are many mechanical therapeutic machines for this.

Osgood then discusses the apparatus for cripples and occupational training, and concludes that in this war orthopedic training has a larger field than in any previous one.

Just as I am finishing this article, I am pleased to have the opportunity to announce that the Orthopedic Group in the Surgeon-General's Office—Majors Brackett, Goldthwaite, Silver and others, have finished for publication a small standard manual on *Military Orthopedics*, to be published with the other war manuals by Lea & Febiger. The committee has taken a great deal from Colonel Jones's book. The chapter on the foot is amplified, and contains a great deal of new matter based upon the experience of Colonel Munson, of the Medical Corps of the Army, and his colleagues. The chapter on splints is more comprehensive than in Jones's book and will practically standardize all the methods to be employed in United States hospitals. This war offers one of the greatest opportunities for orthopedic surgery, and I am confident that we have the men capable of embracing the opportunity and developing it to as near perfection as possible. I trust later there will be published a larger volume on military orthopedics. No book has yet been published which meets the requirements, yet there is sufficient in the literature to make such a volume possible at this time.

Osgood¹ gives a splendid report of his experience with the Harvard Unit at the American Ambulance during the months of April, May, and June, 1915. One will find in this article the more important

¹ Boston Medical and Surgical Journal, January 27, 1916, clxxiv, 109.

methods of extension and fixation apparatus. Through the courtesy of Dr. Osgood, I was able to reproduce, in *PROGRESSIVE MEDICINE* for December, 1915 (p. 293), many of his illustrations. I have referred to them in this article on a number of occasions.

The Soldier's Foot. From the description of Porter, we get the impression that the soldier's stomachs are properly taken care of, and that life in the trenches, even under the most terrible bombardment, is only dangerous from wounds, gassing, and shell shock. Apparently unless the soldier is actually injured, or is infected with some organism, his health remains good. But the literature would suggest that a great deal of inefficiency among the fighting men can be attributed to their feet—trench foot, sore foot, frost-bite, and various forms of flat and weak feet seem to be of common occurrence. Jones is of the opinion that the shoe is largely responsible for this, and is not at all satisfied with the shoe furnished the British soldier. Goodwin describes in detail the care and preparation of the feet for the trenches.

The Surgeon-General's Office is taking every precaution for the inspection of the soldiers' feet and the fitting of their shoes. Fortunately, due to the efforts of Colonel Munson and others, our army shoe seems to meet the requirements, but someone among the officers must understand the fitting of the shoes, the careful examination of the feet for deformities and signs of weakness, and the daily care of the feet and shoes when the burdened soldier must undertake a forced march, or be confined for a long period to a wet trench, or exposure to cold.

In another place I have already mentioned that a Medical Reserve Officer in charge of a large force obtained the most valuable and practical information from Colonel Jones's notes on military orthopedics.

Fitting of Shoes and Care of Feet. The following note is issued as a proposed revision of U. S. Army General Orders No. 45, 1916:

"Company commanders will personally *measure* the feet and *fit* the shoes of men of their commands and will be held responsible that the instructions herein contained are strictly followed.

"All measurements prescribed herein will be taken with the soldier standing in bare feet and with a 40-pound burden on his back, bearing the entire weight upon the foot to be measured. Balance may be preserved by resting the hand on a fixed object. The measurements of the foot, which must be taken to make suitable preliminary selection of the shoe to try on, are (a) the length; (b) the circumference around the ball.

"To measure the length, the soldier will stand with foot upon the foot measure, furnished by the Quartermaster's Corps, fitted in a slot in a board, the heel of the soldier fitting snugly against the heel block. The movable block will then be pushed up until it touches the end of the great toe. The scale on the top of the measure, which is graduated in sizes, will then be read, and the proper length of the shoe will be determined, approximately, by adding 2 to the reading of the scale; thus, if the soldier's foot scales $6\frac{1}{2}$ a shoe not smaller than $8\frac{1}{2}$ should be tried on first.

"To take the ball measure, pass the foot tape, supplied by the Quartermaster's Corps, around the foot at the prominent tubercle at the base of the great toe and the prominent tubercle at the base of the little toe. The position of the tape is shown by the line *A-B* in Fig. 180.

"The tape should lie closely to the flesh, but should not be so tight as to compress it. Having taken the foregoing measurements, the shoe best suited to the foot will be determined by reference to Special Regulations No. 40, War Department. For example, assume that the circumference of the ball is found to be $9\frac{1}{2}$ inches. In the table on page 28 of the aforesaid circular, under the heading 'Marching Shoes,' it will be seen that for a foot requiring an $8\frac{1}{2}$ shoe a ball measurement of $9\frac{1}{2}$ inches corresponds to a D width. The size of shoe to try on for actual fitting is, then, in this case, $8\frac{1}{2}$ D.

"If the ball measurement found as above does not correspond exactly with any ball measurement given in the table, then the narrower of the two widths between which the measurements lies should be selected.

'Beginning with the size and width thus tentatively selected, shoes will be tried on until a satisfactory fit is secured. Correct fit in waist and instep will be determined experimentally. To determine the fact of fit the shoe will be laced snugly and the soldier with a 40-pound burden upon his back will again throw his entire weight on one foot. The officer will then press in the leather of the shoe in front of the toes to determine the existence of sufficient vacant space in that region to prevent toe injury. Under no circumstances should this vacant space in front of the great toe be less than two-thirds inch; nor should there be pressure on the top of the toes. The officer will then grasp with his hand the leather of the shoe over the ball. As his fingers and thumb are brought slowly together over the leather, the shoe should feel snugly filled without apparent tension, while the leather should lie smoothly under the hand. If the leather wrinkles under the grasp of the hand, the shoe is too wide and a narrower width is needed; if the leather seems tense and bulging and the hand tends to slip over easily, the shoe is too narrow and a greater width is necessary.

"Usually it will be necessary to try on several pairs of shoes in this manner before an entirely satisfactory shoe is secured. A record of the proper size and width of shoes as determined above will be kept as provided in Circular 17, Quartermaster General's Office, May 1, 1916.

"Measurements will be taken and shoes will be fitted as prescribed at least once in each enlistment and the record will be changed from time to time if subsequent fittings render a change necessary.

"Sizes called for in requisitions will conform to the record and the fact of fit of shoes issued on such requisitions will be personally verified in every instance by company commanders in the manner above prescribed.

"No shoes will be issued to, or worn by, enlisted men while on duty which are not fitted in accordance with this order.

"New shoes should be adapted to the contours of the feet as soon as possible. Shoe-stretchers, with adjustable knobs, to take pressure off painful corns and bunions, are issued by the Quartermaster's Corps.

"All shoes should be properly broken in before beginning a march. The following is required:

"The soldier stands in his new shoes in about $2\frac{1}{2}$ inches of water for about five minutes until the leather is thoroughly pliable and moist; he should then walk for about an hour on a level surface, letting the shoes dry on his feet, to the irregularities of which the leather is thus molded in the same way as it was previously molded over the shoe last. On taking the shoes off, a very little neat's foot oil should be rubbed into the leather to prevent its hardening and cracking.

"If it is desired to water-proof the shoes at any time, a considerable amount of neat's foot oil should be rubbed into the leather.

"Light woolen or heavy woolen socks will habitually be worn for marching; the socks will be large enough to permit free movement of the toes, but not so loose as to permit of wrinkling. Darned socks, or socks with holes, will not be worn in marching.

"Company commanders, by frequent inspections throughout the year, will maintain the feet of their men in condition for proper marching. They will cause the proper trimming of nails, removal or paring of corns and callouses, relief of painful bunions, treatment of ingrowing nails, and other defects, sending serious cases to the surgeon.

"Before a march is undertaken by foot troops, company commander will personally inspect the bare feet of their men. While on the march, they will personally see each day that their men wash their feet as soon as possible after reaching camp, prick and evacuate blisters, and cover such blisters or excoriations with zinc oxide plaster, supplied by the Medical Department, applied hot, dust the feet with the foot powder supplied by the Medical Department, and put on clean socks. An undue amount of foot injury and disability from shoes will be regarded as evidence of inefficiency on the part of the officers concerned and as cause for investigation.

"Quartermasters will provide a place where shoes may be fitted for the purpose of determining or verifying the record, to be kept in each company, troop, battery and detachment, of the proper sizes of shoes required for each enlisted man thereof. For the purpose of fitting, they will keep on hand at all times a complete series of each size and width of shoes furnished for issue. Company commanders will report in writing to the next higher commander every instance of failure to secure proper shoes for their commands or to obtain proper facilities for fitting the shoes as herein directed. Commanders will investigate the reasons for, and be held responsible, so far as lies in their power, for the rectification of such deficiencies.

"A brief record of the number of such reports from company commanders and the reason for such deficiencies will be furnished to inspectors at each inspection.

"Inspections conducted under the provisions of paragraph 889, Army Regulations, will embrace an inquiry into the manner in which this order has been complied with, and the report of inspections will include a statement of all instances of failure on the part of company commanders to secure proper shoes for their commands and the cause of such failure."

It will be observed that the fitting of the shoe and the care of the feet is to a large extent left to the company commander. Serious cases only are referred to the surgeon.

When I purchased my shoes from the Quartermaster's Department at Fort Howard near Baltimore, the quartermaster made a diagram of my foot, while I stood on a piece of paper, and immediately selected two pairs of shoes. I have worn one pair for ten days continuously with absolute comfort.

It is to be remembered that the medical department has the first chance at the soldier's feet when the recruit is being examined, and it naturally occurs to me, after reading the literature, why should not the future care, including the fitting of the shoe and the inspection, be under the supervision of the medical regimental officer?

Colonel Goodwin, in his book, gives us the information that a private in each company is given a special course for a few weeks on the treatment of corns and blisters, and this man looks after the feet under the personal supervision of the company officers, but he does not specifically state who is responsible for the soldiers' feet—the line or the medical officer.

Preliminary Foot Inspection. Harold C. Corbusier,¹ a medical officer experienced in the National Guard of New Jersey and an orthopedic surgeon, makes a report on his observations and experiments with the feet of the business men at the Plattsburg Camp. He calls attention to the apparent disregard of proper shoeing and care of the feet among the National Guard. He makes the claim that only a few of the States issue the army shoe, and, owing to a woful lack of sizes, the men are not properly fitted. In the majority of the States the men purchase their own shoes, and Corbusier claims that in 90 per cent. of the cases these shoes are injurious to the soldier's foot. He also remarks that, in view of the superficial preliminary examination, many men are recruited in the ranks with pathological feet.

This orthopedic surgeon was dealing with college graduates, as a rule in good physical condition, and he found that their feet did not measure up to standards.

Flat-foot was the most common finding. Claw-foot was less frequent. He had a number of cases of bunion, hallux valgus, conditions which I have described in discussing Jones's book. In addition, he found many examples of overlapping toes, and many corns. The majority of these pathological conditions were relieved by a proper shoe.

After these recruits marched, blisters were the most common result. Their usual location is illustrated in Figs. 181 and 182. Inflammation of the tendon sheaths was common, especially of the tendo Achillis and extensor of the small toe. It is interesting to note that, after one march, 1267 men reported with sore feet; 1200 had blistered feet. He does not give the total number of men marching.

He is of the opinion that these various types of sore feet were explained not only by a badly fitting shoe, or some preliminary pathological con-

¹ Military Surgeon, 1916, xxxix, 518.

dition, but to a faulty gait. He objects to the present regulation of requiring the soldier to stand with the toes turned out at an angle of 45 degrees. The angle should not be over 30 degrees.

He makes the following suggestions for foot rules:

"1. Two or more months before going to camp make a careful inspection of your feet. If there are corns present, whether large, small or soft, your shoes are not the right shape.

"2. Look for badly shaped toes, lapping over, hammer-toes or 'claw' toes.

"3. Look for ingrowing nails and bunions, or any tender and inflamed spots.

"4. See if the arches are painful or obliterated on standing, or if the foot turns outward too much, causing the angle to roll inward.

"5. If you have any of these troubles, seek treatment *at once* from an orthopedic or a general surgeon, *not* from a chiropodist.

"6. *Always* wear a broad-toe shoe and one which is sufficiently long in the 'heel-to-ball' measurement; also, the fit of the heel must be good, not loose, as commonly found in most broad-toe civilian shoes. Obtain the camp shoe recommended by proper authority—it must be broad at the toes; thick-soled; with well-fitting heel; made of oiled leather; pliable throughout, especially in the sole; without lining; the upper of sufficient height to bring it well above the ankle bones; laced, with eyelets only. Wear your camp shoes at least a few hours each day before going to camp, if you have the proper shoe. This is to adjust your foot to the new shape, which is probably different from what you have been wearing."

Arthur S. Jones,¹ Captain, M. O. R. C., gives his experience with foot and shoe inspection of the soldiers in Mexico, with this conclusion: "Had the officers of the line and medical corps been properly instructed, and the soldiers' feet been trained and properly fitted, the percentage of foot trouble would have been *nil*, while, as a matter of fact, it was 21 per cent. in a group of 17,000 men on the march, and 58 per cent. in a group of 11,000 on the march. This percentage of foot trouble is of the total number of men who fell out, and not of the total number of the men marching. The relative number who fell out, it seems to me was small. Of the 17,000—265; of the 11,000—99.

Captain Jones publishes here General Orders No. 26, of August, 1912. General Orders No. 45, of 1916, has just been published here with the proposed revision. Both have to do with the measurements and care of the feet. The diagram for measuring the feet is shown in Fig. 180.

Captain Jones is of the opinion that the army shoe devised by the Board headed by Colonel Munson is admirable.

Officers should be required to wear this shoe as well as enlisted men. The regulation light woolen sock of the quartermaster is superior to all others, and both officers and men should be required to wear it. In ordering the socks, it should be four sizes larger than the shoe, that is, for a No. 6 shoe a No. 10 sock.

¹ Military Surgeon, August, 1917, xli, 219.

Over 30,000 men were inspected. In only 5000—one-sixth, were the shoes properly fitted; in the remaining they were too small, or too large; in about 20,000, too small; in 3000, too large. This does not indicate that the General Orders in regard to the measurement of the foot and fitting the shoe were properly carried out. Naturally, the conditions in the regular army were better than in the militia, but, even among the regular troops many soldiers were found to be wearing an improper size shoe.

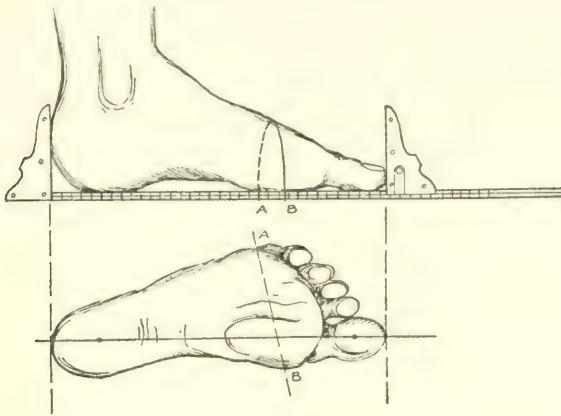


FIG. 180

When the feet themselves were examined, 18,000, or over 50 per cent., had good feet; the remaining had the following deformities: Corns 21,000; crowded or jammed toes, 18,000; hallux valgus and ingrown toe-nail, 8000 each; callosities, 5000; overriding toes, 2000; bunions, 1000. Of course, in this list we see that many soldiers had more than one lesion, but we get the important impression that only about 50 per cent. had good feet. About 24 per cent. had sufficient evidence of weak or flat-foot to justify the recommendation for the foot exercises which will be given in detail later.

It is Captain Jones's opinion that a foot with minor defects should be accepted, because it is possible to develop, in these recruits, serviceable feet. Here he apparently agrees with Colonel Jones. The minor defects are as follows: Hallux valgus, hammer-toe, bunions, callosities, corns, twin-toes, overriding toes, ingrowing nails, weak feet, low arches, moderately pronated and rigid feet. We observe, among the inspected soldiers all of these minor defects have been accepted. I am particularly interested in this statement, because in this country among some of our army surgeons and orthopedic specialists there has been some criticism of Colonel Jones's *Notes on Military Orthopedics*, for including the recognition and treatment of these minor defects, especially hallus valgus and hammer-toe.

Among the major defects which should be cause for rejection, Captain Arthur Jones includes the different forms of arthritis, definite deformities, such as club-foot, deformities from old fractures, with and without

callus formation, spastic and paralyzed muscles, divided tendons, feet from which bones have been removed, feet in which the first, second or third toe is missing; and bunions, with marked bone and joint involvement.

Flat-foot is a minor defect when there is still retained a moderate amount of pronation and flexibility, and no signs of arthritis. The candidate should be accepted.

It is important to note here the opinion of Captain Jones that in these cases of moderate flat-foot accepted, the recruit should not be given plates or arches as a support, but should be made to take the following exercises:

1. The ball of the foot is placed on the sharp edge of a depression in the ground with the toes projecting over the edge. A thick board, table or other secure support may be used. The toes are deliberately bent downward and upward as far as possible thirty times. If the toes do not bend readily, assist them with the hands until they become more flexible.

2. The foot is moved backward to a flat surface and the toes are lifted thirty times.

3. In the same position the toes are separated and closed thirty times. At first it will be necessary to assist this movement with the hands.

4. In the same position, the whole front portion of the foot is lifted and lowered thirty times. The body should be kept erect and there should be no swaying or movement at the hips.

5. The inner margin of the foot is raised and the weight is thrown on the outer edge. The toes are curled downward, backward, and underneath the foot as far as possible, and then brought to a normal position, and this is repeated thirty times.

6. Standing firmly on one foot, the other leg is extended at an angle of about thirty degrees. In this position the anterior portion of the projected foot is made to rotate, describing a complete circle. This exercise brings into play the flexors, adductors, extensors and abductors of the foot.

Apparently, these are the exercises mentioned by Colonel Jones also. The men who are taking these exercises should not have long hours of marching at first.

Colonel Jones describes the proper shoe for feet of this kind, Captain Jones does not, but conveys the impression that shoes properly fitted, and a proper sock, will be sufficient. The shoe can be made more flexible, if it is well greased and not kept in the dark or damp. A soldier should remove the shoes when at rest and elevate the feet. The moment there is a sign of any irritated area, correct, if possible, the shoe and socks, and cover the area with a piece of adhesive strap. It is to be recollected that Captain Hastings, in his little book on *First Aid in the Trenches*, gives each soldier a roll of rubber adhesive plaster, but does not mention its employment to prevent blisters of the feet.

Soldiers, according to Captain Jones, should wash their feet daily not with an excessive amount of soap, and dry thoroughly; expose to the air and sun for a short time. He does not advise the use of pow-

ders, while Hastings advises powdered boric acid and starch for the feet, which is also recommended by Colonel Goodwin in preparing the feet for the trenches.

Captain Jones states that operations for ingrowing toe-nails are rarely necessary; if pressure on the toe is removed, the area beneath the nail cleaned with alcohol, and lightly packed with cotton; in trimming the nails the corners should not be cut.

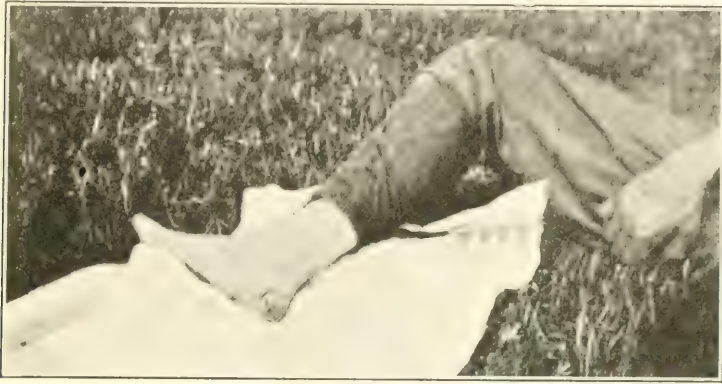


FIG. 181.—Usual location of blisters; note spot where lower end of leggin has rubbed. (Corbusier.)



FIG. 182.—Usual location of blisters; note heel blisters caused by faulty construction of inside of regulation shoe. (Corbusier.)

It is important that the socks should be clean. When it is impossible to wash them, turn them, hang them in the air or sun. Darned socks should not be worn. It is more economical to purchase a new sock than to treat a sore foot.

It is important to remember that Captain Jones's experience is with feet in Mexico, and with soldiers who have to live in the trenches in France. This may explain the slight discrepancies in regard to the

use of powder, and as our army shoe is so much better than the British, it may explain the failure of Captain Jones to recommend certain changes in the boot insisted upon by Colonel Jones of the British Army.

Marching Fracture. A. H. Pirie¹ describes these fractures. They are apparently due to muscular action during severe prolonged marching. The fracture is situated in the second, third or fourth metatarsal bone; two or three bones may be fractured. The patient first observes soreness of the feet, and is unaware when the fracture takes place. Apparently, after the fracture, he struggles on for a time, and then finds himself unable to march farther. Treatment is not mentioned in the review, and I have not had an opportunity to inspect the original.

War Injuries of the Feet. The largest review of war wounds of the foot and ankle is a monograph by E. Quénu.² It is fully illustrated, and, so far as my observations go, it is the most comprehensive study of the war surgery of this region so far published.

Combiér and Murard³ report on 4 amputations and 28 resections in the region of the foot and ankle. These were all done in the zone of advance, in the surgical ambulance.

These two contributions demonstrate that American surgeons should review the well-established methods of amputation in the region of the foot and ankle—uncommon operations in time of peace. They should also carefully review the peace literature on fractures in this area. Undoubtedly, there is a large opportunity for conservative surgery in gunshot wounds of the smaller bones below the tibia and fibula. I have had a recent case in which the fractured astragalus and particles of other small bones were removed at the primary dressing of a shotgun injury of the ankle. In spite of a streptococcus and gas-bacillus infection, the patient recovered with a foot which has good function.

Greenough, Osgood and Vincent⁴ report on their three months' service in the American Ambulance, and their experience with gunshot fractures of the extremities. One-third of the patients in their ward had fracture. Of the 140 fractures, 9 were of the ankle or foot. All were compound. This demonstrates that fractures in this region are relatively infrequent.

Fractures of the Os Calcis. Forrester⁵ recommends primary tenotomy of the tendo Achillis for reduction and prevention of future disability. The foot is put up in plaster, with hyperflexion, marked eversion, and a pad under the arch.

Cotton and Henderson⁶ discuss 75 cases of compression fracture of the os calcis. To get good results and prevent future disability, he recommends the Cotton reduction, as outlined in 1908. Late operations, as a rule, are unsatisfactory.

¹ Lancet, July 14, 1917, ii, 47; review in Journal of the American Medical Association, 1917, lxi, 495.

² Revue de chir., 1917, xxxv, 246 and 541.

³ Bull. et mém. Soc. de chir. de Paris, 1916, xlii; review in Surgery, Gynecology and Obstetrics, 1917, cciv, Abstr. 590.

⁴ Boston Medical and Surgical Journal, January 13, 1916, clxxiv, 37.

⁵ Review in Surgery, Gynecology and Obstetrics, 1917, xxiv, Abstr. 501.

⁶ American Journal of Orthopedic Surgery, 1916, xiv, 290.

Lounsbury¹ emphasizes the difficulty of diagnosis without *x*-rays, the importance of immediate reduction, often helped by division of the tendo Achillis, and the proper after-treatment.

Fred J. Cotton² gives, with illustrations, an excellent resumé of this fracture, and of the so-called Cotton reduction (Fig. 183) which he devised in 1908.

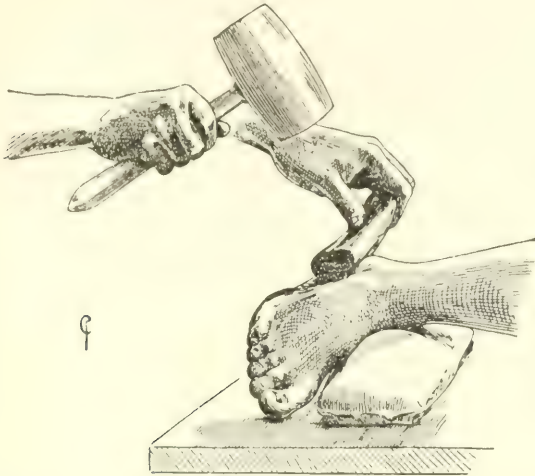


FIG. 183.—Treatment by impaction. The foot is laid on a sand-bag, a felt pad held to protect the outer side of the os calcis, which is then impacted by blows from the mallet. This impaction is used only after careful correction of position. (Cotton.)

P. B. Magnuson³ describes and pictures his method of reduction, which is by manipulation after a subcutaneous tenotomy of the tendo Achillis, and the method of fixation in plaster—marked inversion, with pressure under the instep. He does not refer to Cotton's method or contributions, and claims that, when performed as a primary measure, he has observed no permanent disability.

Fractures of the Astragalus. Robinson,⁴ for this fracture with dislocation, makes an incision, pries the fragment into place, closes the wound without drainage, and puts up in plaster.

Albert H. Montgomery⁵ considers only fractures of the neck of the astragalus. In the majority of cases recorded in the literature, partial or complete removal of the bone has been performed. The partial operation is the one of choice. In spite of apparently good results, Montgomery is of the opinion that if the patient is seen early, open reduction is possible and should be the operation of selection.

In compression fractures of the astragalus and gunshot wounds, partial or complete removal of this bone may often be necessary. For this reason, I refer to the splendidly illustrated article of W. R. McAus-

¹ *Surgery, Gynecology and Obstetrics*, 1916, xxii, 638.

² *Annals of Surgery*, 1916, lxiv, 480.

³ *Journal of the American Medical Association*, 1917, lxxviii, 530.

⁴ *Annals of Surgery*, 1916, lxi, 606.

⁵ *Ibid.*, lxxv, 495.

land¹ on Whitman's method of removing the astragalus in infantile paralysis.

Jones has called our attention to how helpful his experience in the operative treatment for reconstruction in the paralytic deformities of infantile paralysis, has been to him in military orthopedics.

Trench Foot. Colonel Goodwin describes its prevention. Frost² gives a very good resumé of the subject up to March, 1917. It occurs chiefly in the winter months. It has various names—frost-, water- and boot-bite, chill-foot and trench frost-bite. The term, however, trench foot seems the best. It was observed in the Balkan wars chiefly among the Greek troops. It has invalidated several thousands of British and French soldiers. The symptoms vary. Usually only one foot is involved. Getting wet in cold weather is apparently an important factor. First, the feet feel numb and cold, then there is swelling, pain and tenderness of various degrees; the tenderness is chiefly in the ball and heel; pain may extend up the leg, with muscle tenderness in the leg and thigh. On examination, in the simplest type, there are varying degrees of hyperemia, usually at the pressure point on the foot. Anesthesia and hyperesthesia are often present: anesthesia in the hyperemic areas, hyperesthesia outside. In more severe cases the discoloration is deeper with the formation of vesicles and ulceration. The toe-nails become dark, the foot swollen. In some cases superficial gangrene develops. It is less apt to develop in men who move about and protect themselves from cold and wet. The treatment is simple, but often the men will have to be transported back on stretchers. The preventive treatment is given more fully by Colonel Goodwin, which I have quoted.

V. Raymond and J. Parisot³ are of the opinion that trench foot is due to an infection with a fungus, and they have gotten good results from the following treatment: A mixture of camphor 1.1 grams; sodium borate 1.5 grams; boiled water 1000 grams. The feet are dressed with cotton wet in this solution. This is practically the preparation advise by Goodwin. Some of the more severe cases should be protected by the antitoxin of tetanus. The large majority of cases recover in from three to five weeks and return to duty.

D. Bruce⁴ emphasizes the importance of the early injection of tetanus antitoxin in cases of trench foot.

H. C. Smith⁵ advises the subcutaneous injection of oxygen for trench foot.

This summary is a pretty good demonstration that at least a group of medical officers should receive special instruction in the preliminary examination of feet, the fitting of shoes, the care of the soldier's foot, the treatment of the simpler conditions, which do not disqualify for service; the early recognition and treatment of the various conditions that a soldier may suffer from in spite of preventive treatment, and

¹ Journal of the American Medical Association, 1917, lxviii, 239.

² Boston Medical and Surgical Journal, March 1, 1917, clxxvi, 301.

³ Paris médicale, 1917, vii, 238; review in Journal of the American Medical Association, 1917, lxviii, 1511.

⁴ British Medical Journal, January 13, 1917, i, 48.

⁵ Ibid., April 21, 1917, i, 511.

the special knowledge of the conservative operations for gunshot wounds in the region of the ankle and foot. There is sufficient material for a small war manual.

AMPUTATION. This war has created a new field—the surgery of the amputated stump. Amputation for injury is practically always an operation of necessity, and therefore it must be hurried. In the great majority of cases in this war, the amputation is made necessary on account of infection, and the wound cannot be closed. For this reason most of the stumps require a second operation of a plastic character to prepare it for the prosthesis.

I find, then, a new literature conspicuous by its absence before. I am informed that in London a special hospital has been organized for the reconstruction of stumps.

G. M. Huggins¹ calls these rapid amputations “guillotine,” and advises that no secondary operation be done until there has been extension for six weeks and the edema has disappeared. When the stumps are above the middle of the leg, or the middle of the thigh, they should never be shortened until healed, unless it is absolutely necessary to sacrifice the knee- or hip-joint. When reamputating such stumps, always have in mind the minimum length of bone which should be left beneath the knee- or hip-joint. Often these guillotine amputations make a satisfactory stump on the leg and thigh as well as in the forearm and arm. Remember, there is no harm in putting off the operation, while there is a distinct risk in reoperating too soon. Latent infection is often present. In these cases the vessels are surrounded with scar tissue, and silk should not be employed as a ligature. In these secondary amputations make skin flaps only, do not employ muscle. Every nerve in the stump should be isolated and divided high. After the operation there must be daily exercise of the joint, with the employment of special splints and bandages for the preparation of the stump for the artificial limb. The Syme amputation is good, but amputation through the tarsus should never be done as a secondary measure.

In the literature on tetanus, we find this important advice which should be emphasized here: Before every reamputation give the anti-toxin, as the tetanus spores may be present, though dormant, in the scar tissue. The trauma of the operation may excite their growth and postoperative tetanus will take place.

Tuffier² writes on the results of his studies of 1731 amputations: The scar should not be over the extremity of the bone. For disarticulation at the hip, use a racket incision. Subtrochanteric amputation should always be preferred to hip-joint disarticulation. Disarticulations of the knee-joint do not give good stumps. Amputate in the leg as low as possible. When it is necessary to amputate the leg in the superior fourth it is far better to amputate above the knee-joint. This short leg stump is useless and dangerous. In amputations of the leg, make a long

¹ *Lancet*, April 28, 1917, i, 646; reviewed in *Journal of the American Medical Association*, 1917, lxviii, 1667.

² *Bull. de l'Acad. de méd.*, December 21, 1915; *Military Surgeon*, April, 1916, xxxviii, 446.

posterior flap, if possible. According to Tuffier, the circular method, the one apparently of choice in peace surgery, should be abandoned as a method of choice in war surgery. Tibiotarsal disarticulation, Lisfranc's and Syme's amputations give good stumps; Chopart's has given poor stumps.

In the arm and forearm, the circular method may be used. In the forearm make as long a stump as possible. At the shoulder the intradeltoid amputation is to be preferred to a disarticulation. In the forearm, the longer stump makes it easier to fit a prosthesis, and one should insist upon early pronation and supination. At the wrist, if possible, make a palmar flap.

The subject of prostheses in England is reviewed in the *Military Surgeon* (November, 1916, xxxix, 553). There is also a very interesting paper—a historical review of prosthetic appliances in war time, by F. H. Garrison.¹

NERVES. In previous December numbers of *PROGRESSIVE MEDICINE* since 1914, I have covered pretty thoroughly the literature of nerve injuries from gunshot wounds, and in this number I have given the views of one of England's most expert orthopedic surgeons.

The literature on this subject is apparently not as large this year as in the past, and there is nothing particularly new. Apparently, Jones emphasizes the most important point—that it is not so much the technic of the nerve suture or graft or anastomosis, as the constant attention to muscle function and joint motion during the healing of the wound, and the proper position of the extremity.

When function must be restored by means other than an operation on the injured nerve, the large peace experience in infantile paralysis will be found of the greatest value. Cases of nerve injury are practically orthopedic problems, and general surgeons without orthopedic experience must not assume the responsibility of these cases.

There is an excellent summary by Herman Fischer² on gunshot wounds of the nerves and their treatment based upon an experience of 7 operative cases and 8 cases which recovered after massage and electric treatment. These 15 cases of nerve injury occurred among 365 wounds of the upper and lower extremity. Fischer gives a number of good illustrations, but no references to the literature.

Carl Connell,³ in discussing this paper, emphasises the importance of training in the diagnostic indications of when to operate, and skill in the technic of the isolating dissection and suture. This paper was also discussed by Dean Lewis, of Chicago, who has done some of the best and most recent work on nerve suture. Lewis takes a piece of fascia from the individual, makes a tube, smooth sides lining the tube. This is used as a bridge. It seems unnecessary to fill this tube with agar or any other substance. The serum from the wound will fill the tube and act as a framework to carry the regenerating nerve fibers. It is always best to use an autograft of fascia.

¹ Bull. de l'Acad. de méd., December 21, 1915; *Military Surgeon*, April, 1916, xxxviii, 507.

² *Annals of Surgery*, 1917, lxy, 56, 383.

³ *Ibid.*, p. 383.

BLOODVESSELS. I have reviewed pretty thoroughly the experience of this war in *vessel injury and aneurysms*.

Pearson² summarizes the entire subject up to 1916, and confirms the conclusions of my previous reviews, that in spite of the splendid development and success of vessel suture, ligation is still the most suitable operation in the majority of cases of vessel wounds and aneurysms due to gunshot wounds. The best time to operate is usually within two to four weeks. In practically every instance one should attack directly the area of the wounded vessel or aneurysm. That is, all should be treated as progressive internal hemorrhage. The contents of the sac of an aneurysm should always be removed. Pearson prefers to operate under the Esmarch or elastic constriction. He uses Carrel's technic, except he has substituted liquid paraffin for vaseline. If there is no infection, he employs silk; if there is, catgut. When end-to-end anastomosis is done, he reinforces with fascia transplant. Many cases of arterio-venous aneurysm and aneurysmal varix do not require operation, while varicose aneurysms demand the same early operative treatment as a simple aneurysm. The varicose aneurysm should be approached by opening the sack and ligation of both artery and vein. If one vessel should be preserved, let it be the vein. The exception to this rule is in the neck; preserve the internal carotid artery, and ligate the internal jugular vein.

As to the *point of the ligation of the vein when the artery is ligated*, we have an interesting contribution by E. Sehr³ who is of the opinion that the *danger of gangrene* is less when both artery and vein are ligated. This problem has been discussed again and again in the literature on aneurysms, and, so far as I am able to judge of the merits of the controversy, it is not yet settled. If I can read the war literature aright, the huge experience with bloodvessel injuries seems to show that excellent results are obtained if attention is confined to the injured vessel, leaving the uninjured alone.

Apparently, surgeons have been very interested in wounds of large bloodvessels without hemorrhage. Bertein⁴ calls attention to two interesting varieties of *arterial obliteration after injury*. One is due to section of the vessel, and the other to contusion.

In PROGRESSIVE MEDICINE for December, 1899 (p. 187), I reviewed the article of Hertzog on traumatic gangrene from rupture of the inner coats of the artery after a contusion and fracture. In peace surgery Bertein states that it is not unusual to observe in a severed limb immediate hemostasis in the ends of the large torn vessels. This has again been observed, and more frequently in war wounds, but the author emphasizes that, notwithstanding the absence of hemorrhage, the ends

¹ PROGRESSIVE MEDICINE, December, 1915, 1916.

² British Medical Journal, 1916, ii, 796; review in Surgery, Gynecology and Obstetrics, 1917, xxiv, Abstr. 510.

³ Med. klin., December 17, 1917, xii, 1338; review in Journal of the American Medical Association, 1917, lxxviii, 666.

⁴ Presse méd., 1916, p. 581; Surgery, Gynecology and Obstetrics, 1917, xxiv, Abstr. 395.

of the severed vessels should be sought for and ligated as carefully as if they were bleeding.

Planson¹ comments on the so-called dry or staunch wounds and the importance of finding and ligating the torn vessels. He is of the opinion that a number of cases of secondary hemorrhage attributed to sepsis, are better explained by the failure to find and ligate these temporarily occluded torn large vessels. He refers to a communication of Duval² on the same subject. Baggio³ calls attention to wounds of the antero-interior aspect of the thigh in which vessel injury is apt to be overlooked, and in which gangrene due to sepsis may develop later on account of poor circulation. Wounds of this kind require specially large and early incision.

SURGICAL BACTERIOLOGY. *Antitoxin for the Gas-bacillus Infection.* Simon Flexner, Director of the Rockefeller Institution, wrote me August 20, 1917, as follows: "I find in your recent article⁴ on Gas-bacillus Infection; Surgical Bacteriology the following paragraph: 'If we had today for the gas bacillus a protective serum as efficacious as those for tetanus and typhoid, wounds in this war would be a different problem.' A protective serum of this sort has now been produced, and I am mailing you under separate cover a report of this work."

This discovery was made by Carroll G. Bull,⁵ who demonstrated his experimental animals before the Medical Section of the National Council of Defense which met in the Rockefeller Institute early in September. There seems no question that, from the stand-point of animal experimentation, the efficacy of the antitoxin was established. In the few human cases it seemed to have equally good results. I am informed that Bull has left for France to test the practicability of his antitoxin serum on the wounds there.

If what we hoped turns out to be true, this will be the great contribution of the war in surgical bacteriology, but there are other organisms besides the gas bacillus and that of tetanus to be combated in infected wounds, and there is still a large open field for protective and curative sera and chemotherapeutic agents.

RECONSTRUCTION AND REÉDUCATION. This is too large a problem for more than mention here, but it will be interesting to note that the Surgeon-General's Office has created a special department under the head of Major Edgar King, who is preparing, in a most careful and thorough manner, a scheme for the administration of this big undertaking beginning in the zone of advance and ending when the soldier is discharged with a new job.

The larger part of reconstruction will come under the orthopedic group. This, in the Surgeon-General's Office, is being organized under Major Brackett, of Boston. The department of military orthopedics

¹ Journal of the American Medical Association, 1917, lxxviii, 298.

² Ibid., 1916, lxxvii, 1613.

³ Policlinico, 1917, xxiv, 669; review in Journal of the American Medical Association, 1917, lxi, 157.

⁴ Surgery, Gynecology and Obstetrics, 1916, xxiii, 182; PROGRESSIVE MEDICINE, December, 1916, p. 272.

⁵ Journal of Experimental Medicine, July, 1917, xxvi, 119.

in France will be under the direction of Major Goldthwaite, of Boston. There also will be much reconstructive work in wounds of the head. This entire group is under the direction of Colonel Lyster, of the Medical Corps of the U. S. A., and the development of the special group for oral plastic surgery is being taken care of by Captain Blair, of St. Louis.

From the moment of the injury, everyone in charge of the wounded must have a clear understanding of the great importance of doing more than saving life and limb, but to so treat the injured that the period of disability will be short, and the ultimate restoration of function the best obtainable by our present knowledge and means. It is not only important for the medical department to return as many wounded as possible to the firing line, but to so care for the remainder that their handicaps will be reduced to a minimum. Even when this scheme is carried out in an ideal way, the number of cripples will be large. They will need apparatus and artificial limbs, and a large number will have to be re-educated for labor of mind or body, different from their previous occupation.

There is an interesting editorial¹ on this question. It calls attention, first, to the psychological side of the reëducation work. The soldier must not be allowed to become depressed or dependent. His sense of individual responsibility must be maintained; it must be clearly demonstrated to him that although he may be handicapped by his wounds, he can be educated to be a wage-earner, and a home-keeper in some other line of work. Reëducation, therefore, must begin in France, and the patient must not be discharged from the army after he gets home until his reëducation is complete and a new job is found for him. One can readily see that we shall need, in addition to orthopedic surgeons and other members of the medical profession, a large corps of other teachers, vocational, social workers, placement experts, representatives of labor and employers. This department is well organized in France, England and Canada, and we will have no difficulty in getting the necessary information. There is every reason to believe that we can improve upon it.

This problem of reëducation of the handicapped is one of peace as well as war, but I fear that our industries have only recently begun to take an interest in it, and for this reason they will be less able to help them than if they had attacked the problem years ago. Perhaps more has been done in the reëducation of the adult blind than in any other group. I am sure that the industries will learn much from the experience in this war.

¹ Boston Medical and Surgical Journal, September 20, 1917, p. 423.

PRACTICAL THERAPEUTIC REFERENDUM.

By H. R. M. LANDIS, M.D.

Aconite. Achard¹ especially recommends aconite for the relief of *congestion*. It is particularly useful in the *catarrhs* of children, in *tonsillitis* or in *acute sore throat*. Given early in these conditions, the dry, hot, burning skin grows moist in a few hours and then becomes bathed in a profuse perspiration, and with this comes speedy relief from many of the distressing symptoms. He states that if a quinsy is caught at the start it rarely fails to yield to full doses of aconite. W. H. Thomson also highly recommends aconite in cases of *pharyngeal irritation* due to cold, *tonsillitis* and *laryngitis*. In the management of *angina pectoris* he depends largely on aconite, which should be given in large doses and over a period of months. In those cases of excessively high arterial tension, when it is advisable to reduce the pressure, aconite is far preferable to the nitrites. In sudden congestions due to exposure to cold and wet, and which manifest themselves as a "cold" in the head, stoppage of menstruation, etc., the prompt use of aconite will usually restore the circulatory equilibrium and avert subsequent illness.

Butler believes there is no more efficient method to break up a cold than by the administration of aconite in small doses at frequent intervals, followed by an 8- or 10-grain Dover's powder.

Adrenalin. In *PROGRESSIVE MEDICINE* for December, 1916, Meltzer's adrenalin treatment of *acute poliomyelitis* was reviewed. It will be recalled that there was considerable controversy over the merits of this method. The treatment, as outlined by Meltzer, is to first make a spinal puncture and withdraw the spinal fluid if under pressure. Following this, 2 c.c. of commercial adrenalin solution, 1 to 1000, is injected intraspinally. The injections are given every six hours, day and night, until the temperature remains normal for forty-eight hours. In order to get rid of the 0.5 per cent. chloretone, which is placed in the adrenalin solution for preservative purposes, the bottle of adrenalin, with the cork removed, is placed in a water-bath at boiling temperature for two or three minutes. The chloretone-free solution, undiluted, is then injected. In those cases in which there is respiratory involvement it is recommended that the injections be given with the patient in the lateral prone position. Putting the patient face downward embarrasses the respiration and increases cyanosis. The point of election for the injection is between the fourth and fifth lumbar vertebræ. Care should be exercised to see that the needle does not go through the same skin puncture the second time, lest infection be carried into the cerebrospinal fluid.

¹ *American Journal Clinical Medicine*, April, 1917.

Lewis¹ points out that the mortality in New York last summer was 23.9 per cent., whereas in 77 cases of acute poliomyelitis treated by this method, 59 survived. Of the 59, there was a complete recovery in 21, or 35.57 per cent.; great improvement, with all indications that complete recovery would follow, in 21, or 35.57 per cent.; and probable permanent disability in one or more groups of muscles in 17, or 28.79 per cent. Hass² reports 8 cases, in which 3 recovered from the use of adrenalin given intraspinally. In contrast to these were 5 in which this treatment was not used; of these, 2 died of respiratory paralysis, 1 has a flaccid paralysis of both lower extremities after eight weeks, 1 a spastic paralysis of both lower extremities after six weeks, and 1 made a complete recovery.

Experimentally, Auer and Gates³ found that the injection of adrenalin into the trachea results in its diffusion into the pulmonary alveoli with great rapidity and its corresponding rapid absorption. Studies of the blood-pressure and other vital functions showed that the adrenalin rapidly produced a physiological effect. The quantity which they employed varied from 0.15 to 0.03 c.c. (1 to 1000 solution) per kilogram of body weight. Sometimes the injection was made by means of a filiform catheter introduced into the bronchus; in other instances it was directly sent into the lung tissue through the wall of the chest, and in still other instances directly through the walls of the trachea by means of a hypodermic needle. Although they are prepared to present any results obtained by such intratracheal injections of adrenalin in human beings, they nevertheless conclude that such injections can be made repeatedly without harm. They believe that their experimental results warrant them in recommending this plan in cases in urgent need of resuscitation.

In the treatment of *hematemesis*, Cross⁴ recommends, if the hemorrhage is small, 10 to 20 drops of the usual stock 0.1 per cent. solution of adrenalin chloride. If contact of the adrenalin solution and the ruptured vessel is effected we may look for the physiological action of the adrenalin to last from one-half to two hours.

In the treatment of *nephritis*, Ercolani⁵ recommends the use of *adrenalin*. He quotes Liciardelli to the effect that in one epidemic of *scarlet fever* observed by him there were 36 cases of nephritis, and, of these, 25 per cent. died. In a later epidemic 30 per cent. had nephritis, but under the use of epinephrin none died.

Alcohol. The EFFECT OF ALCOHOL IN IMPAIRING THE FINER MOVEMENTS has often been demonstrated. Totterman⁶ has recently made some personal observations. He used as a method of determining the influence of the drug his ability to thread needles. The experiment was conducted over a period of forty-three days, two weeks free from alcohol alternating with two weeks under the influence of 100 c.c. of

¹ Medical Record, September 23, 1916.

² Journal of Experimental Medicine, June, 1916.

² Ibid., September 2, 1916.

⁴ Long Island Medical Journal, January, 1917.

⁵ Gazzetta degli Ospedali e delle Cliniche, March 15, 1917, Abstract Journal of the American Medical Association, June 2, 1917.

⁶ Abstract, Journal of the American Medical Association, February 3, 1917.

a 25 per cent. solution of alcohol taken each evening at 11 P.M. The test consisted in the attempt to thread as many needles as possible in a given time. The tests were made at 10 A.M., eleven hours after the ingestion of the alcohol. Some of the charts showed a noticeable falling off under the influence of alcohol; for example, in one test the number of needles threaded dropped from 182 to 160 in the first period (five minutes) and from 185 to 158 in the second. It is not clear from the abstract (the original is in Swedish) whether the author considered the influence of alcohol was noticeably deleterious or not.

In a study of the EFFECT OF ALCOHOL ON RESPIRATION IN MEN, Higgins¹ found that alcohol (ethyl alcohol, 30 to 45 c.c.) sometimes tended to increase the sensitivity of the respiratory center as shown by a drop in the alveolar carbon dioxide tension; in other instances it was without action on the respiratory center. Alcohol did not have any bronchoconstrictor and seldom any bronchodilator action, as shown from a determination of the dead space of breathing. The respiration rate was not appreciably affected by alcohol nor was the type of respiration changed unless there was restlessness. The heat production, as indicated by the oxygen consumption, was ordinarily unchanged; in about one-fifth of the experiments there was a rise in heat production of from 5 to 7 per cent.

In about 45 per cent. of Higgins's experiments there was a relative acceleration of the pulse rate after taking alcohol as compared to taking the control solution.

In consideration of the status of alcohol from the stand-point of pharmacology and therapeutics, Fantus² states that while alcohol has certain definite uses in the treatment of disease it is by no means indispensable, and in the hands of the people it is a dangerous habit-producing narcotic. In his opinion the medical profession should range itself on the side of those who are its enemies.

Ammonium Chloride. This drug for many years enjoyed the reputation of being an excellent expectorant in cases of inflammation of the mucous membrane of the bronchi. Of recent years the usefulness of the drug in such cases has been questioned. Coleman³ has reported the results of some observations. He selected individuals with *acute* or *chronic bronchitis*. The sputum was collected before the administration of the drug and at various times thereafter. The dose varied from $\frac{1}{2}$ grain every two hours to 5 grains every two hours. In one case of mild acute bronchitis the drug was given in $\frac{1}{2}$ -grain doses every two hours. Distinct loosening of the sputum followed. The taste of ammonium chloride was evident in the sputum at first, later the sense of taste for all substances was blunted. Whenever the drug was stopped the sputum became less abundant, more tenacious, and more difficult to expel. In addition a sensation of dryness or tightness developed in the chest. When the drug was resumed the opposite effects were noted. Coleman repeated this experiment often enough to convince himself

¹ Journal of Pharmacology and Experimental Therapeutics, May, 1917.

² Journal of the American Medical Association, July 7, 1917.

³ American Journal of the Medical Sciences, October, 1916.

as to the accuracy of the observations. He is therefore convinced that the drug has definite expectorant properties. It probably acts by increasing the water of secretion and softening the mucus.

Antimony and Tartar Emetic. Antimony or its derivative, tartar emetic, has established its efficiency in various *protozoan diseases*. Castellani¹ believes that tartar emetic can be considered as a specific in *espiundia*, *granuloma inguinale*, *kala-azar*, and *oriental sore*. In addition it has a powerful action in *trypanosomiasis*. It can also be employed in the treatment of *yaws*, especially if combined with other drugs, and is of service in the treatment of *relapsing fever*.

Tartrate of antimony and potassium in the treatment of leishmaniasis is recommended by Neiva and Barbara² and Escomel.³ The first-named observers advise the use of a 1 per cent. solution in saline. It cannot be sterilized by heat, as this destroys its therapeutic properties. It can be sterilized, however, by passing the solution through a Chamberland F or Berkefeld V filter. It is well borne except in the case of chronic kidney lesions. The solution is given intravenously. The first dose is 5 c.c. of the 1 per cent. solution. If the first dose is well borne the subsequent doses are 10 c.c. Neiva and Barbara report 3 cases in which favorable results were obtained. In these cases the disease was of from two to eight years' standing. The drug may be administered daily if necessary.

Escomel reports a single observation in which the patient had superficial ulcerations which resisted all forms of treatment. He treated the ulcers by dusting them with tartar emetic after applying an anesthetic consisting of a mixture of equal parts of menthol, cocain, and crystallized phenol. In addition the patient was given two intravenous injections (5 c.c. each) of a 1 per cent. solution of tartrate of antimony and potassium. Escomel⁴ also reports a case of *blastomycosis* treated with tartar emetic. In this disease the drug failed to produce favorable results.

Rogers⁵ has reported 18 cases of *kala-azar* treated with tartar emetic. His results were strikingly good, 13 having been cured. In a later communication he states that he has cured 20 cases. One patient subsequently died from pulmonary tuberculosis after the *kala-azar* parasite had disappeared from his spleen.

The *British Medical Journal* of January 6, 1917, points out that since 1906, when Nicolle and Mesnil first recommended the use of antimony in *trypanosomiasis*, this drug has also been used in the treatment of dermal leishmaniasis, ulcerating granuloma, and Mediterranean and Indian *kala-azar*. To Broden and Rodhain belong the honor of having first devised the method of giving the salt intravenously, a procedure which got over the difficulty of oral and subcutaneous administrations. The results obtained in the different diseases mentioned have been satisfactory on the whole, but the difficulty of completely eradicating

¹ British Medical Journal, October 21, 1916.

² Prensa Medica Argentina, April 10, 1917.

³ Cronica Medica, Lima, Peru, November 7, 1916.

⁵ Lancet, November 4, 1916.

⁴ Loc. cit.

protozoan parasites is well known, and in trypanosomiasis, at any rate, relapses have not been infrequent even after several courses of antimony injections. Great success has followed intravenous injections of tartar emetic in that intractable form of ulceration known as "ulcerating granuloma of the pudenda," and what is known as dermal leishmaniasis in South America has also reacted very favorably. Following up these discoveries many different authors have employed such injections in kala-azar, the results obtained having been much better than by any previous method of treatment.

Rogers¹ points out that although the discovery of the value of quinin in *malaria* has been of incalculable value, nevertheless even quinin is not an ideal drug for the disease, because although it rapidly kills the intracorpuseular stage of the parasite and brings about the cessation of the febrile paroxysms, yet it completely fails to destroy the extracorpuseular cycle, which is responsible both for the frequent relapses of the *ague*, and, still more important, for the infection of mosquitoes and through them of other persons. Rogers's success in the cure of kala-azar by the use of tartar emetic intravenously led him to hope that this drug might be of service in killing the malarial parasites, especially the malignant tertian crescents. In a preliminary report, Rogers records 3 cases in which his hopes were realized.

In the first of the cases the effect of the tartar emetic on the malarial parasites was very striking, but in the second and third it appeared to be less efficient than quinin against the intracorpuseular stages of the parasite, while it is certainly far less convenient, owing to the administration of quinin by the mouth being much simpler than giving an intravenous injection.

Much further experience will be required to settle these points, but the indications to be derived from these few cases appear to be that quinin should be used to check the malarial paroxysms, while tartar emetic should subsequently be given intravenously in the hope that it may prove of value in destroying the extracorpuseular stages of the malarial parasites, and so prevent relapses and greatly lessen the infectiveness of the patient to malaria-bearing mosquitoes by killing the crescents of the malignant tertian variety and the corresponding resisting forms of the other types of malaria.

The initial dose of the tartar emetic in one case was 4 cg. intravenously, 8 cg. on the fifth and eighth days respectively, and 12 cg. on the eleventh day. In another case of acute malignant tertian fever yielding to quinin, with the subsequent appearance of numerous crescents, the latter disappeared after two injections of 8 cg. of tartar emetic, one on the second and one on the ninth day.

This observation of Rogers's is not only interesting but important, and will doubtless stimulate others to try the effect of the drug in these cases.

Since the publication of Rogers's article, Low and Newham² have reported a case in which a daily estimation of the crescents was made

¹ British Medical Journal, January 6, 1917.

² Ibid., March 3, 1917.

after the use of tartar emetic. In this case the antimony had not the slightest effect on the crescents, their number fluctuating up and down irrespective of the injections. Later they obtained beneficial effects from the use of 10 minims and increasing doses of arsenic.

Bonne¹ has used tartar emetic in several cases of *venereal granuloma* which had resisted other forms of treatment. In one patient injections of tartar emetic were given in several places wherever the very small veins could be made visible, the solution containing 1 mg. of tartar emetic in 1 c.c. of normal saline. In the first injection 60 c.c. were given, containing 60 mg. of the drug. This was preceded by 50 c.c. of normal saline, and the last traces of tartar emetic were washed out of the apparatus by another 50 c.c. The tartar emetic cannot reach the subcutaneous tissue in this way if care is taken that the point of the needle is in the lumen of the vein. If this precaution is observed there will be no pain during or after the injection. After a number of injections (10 in all) the granulomatous tissue was replaced by healthy epithelium.

Apocodeine. This new laxative is reported by Alvarez² to possess exceptional advantages in the treatment of *constipation*. The drug is made from codeine just as apomorphine is made from morphine. The apocodeine has very little sedative action and has more laxative effect than codeine. In addition it has a pronounced nicotine-like effect, paralyzing the sympathetic nerve cells and blocking the inhibitory influences of the bowel. It also improves the tone of the intestinal muscle, and by vasodilatation improves its blood supply.

Alvarez administers the drug in doses of from $\frac{1}{10}$ to $\frac{1}{5}$ grain. Ordinarily he gives it in combination with atropine in the following prescription:

Apocodeine hydrochloride	gr. $\frac{1}{10}$ to $\frac{1}{5}$
Atropine sulphate	gr. $\frac{1}{200}$ to $\frac{1}{100}$
Sugar of milk	gr. ij
Place in capsules.	

One of these capsules is given two or three times daily, after meals.

In suitable cases two or three capsules daily will insure a normal movement.

The drug, according to Alvarez, can be used for several years, and also possesses the advantage that the dose can be gradually diminished and finally discontinued. He emphasizes the fact that the drug is free from any tendency to habituation.

Arsenic. In discussing the various factors involved in the therapeutic action of arsenic, Jagic³ states that its main effect is the stimulation of assimilation under small doses. Its action on the blood picture is varied and irregular. The improvement in weight and flesh under arsenic may prove deceptive, as the blood disease itself may not be essentially modified. Jagic believes that a stimulating action on the suprarenals is also likely, and to this fact is to be ascribed much of the

¹ Journal of Tropical Medicine and Hygiene, May 15, 1917.

² California State Journal of Medicine, September, 1916.

³ Medizinische Klinik, December 17, 1916.

favorable effect the drug produces. In his own experience in treating *anemia* he found that in chlorosis arsenic had to be supplemented with iron to accomplish its purpose. If, however, obesity is present the arsenic is not required. In pernicious anemia, arsenic may improve the general condition, although the blood picture continues to grow worse. In the acquired anemias, arsenic seems to promote regeneration of the red cells, and the production of hemoglobin if some constitutional weakness of the blood-producing organs does not prevent. In *leukemia*, arsenic often proves effectual in the myeloid form if long kept up, especially when combined with radiotherapy. The outlook is better the smaller the proportion of large, ungranulated marrow elements in the blood. The more granulated elements the better the response to both arsenic and the röntgen rays. In this form of leukemia, as well as pernicious anemia, the remissions seem to be rendered more durable by arsenic.

Aspirin (Acetylsalicylic Acid). Owing to the patent rights on this drug the price paid for it has always been exorbitant, especially when contrasted with that paid in other countries. As the patent has expired the present holder is attempting to perpetuate the name "aspirin" under the name "Aspirin-Bayer," in order to mislead the public into the belief that this is the real aspirin. The method of manufacture is now common property, and it can be made by anyone. The Council on Pharmacy and Chemistry¹ of the American Medical Association emphasize these points, and urges physicians to abstain, in the future, from the use of the name "aspirin." In prescribing the drug it should be referred to as acetylsalicylic acid.

Benzol. In reporting a case of *myelogenous leukemia*, Winslow and Edwards² draw the following conclusions: (1) benzol produced marked diminution of the white cells and its use is attended with benefit in leukemia; (2) benzol frequently produces marked irritation when given either by mouth, by rectum, subcutaneously or intravenously; (3) benzol is a dangerous drug and its administration should be carefully watched for both the symptoms of benzol poisoning and for a too marked or too rapid reduction of the white cell count; (4) benzol cannot be used intravenously.

Barry and Ketcham³ emphasize the fact that one should never forget that the drug is a powerful poison and not carry its effects too far, thus completely destroying the function of the bone marrow and substituting a grave aplastic anemia for the leukemia. The patient should be in a hospital in bed; the gastro-intestinal tract, kidneys, and liver watched carefully for toxic symptoms; and blood counts should be made every few days. The benzol should not be increased in dosage without definite indications, and its administration should be stopped entirely considerably before the white count has returned to normal. If these precautions are observed they believe the drug can be used without danger.

¹ Journal of the American Medical Association, January 20, 1917, p. 201.

² New York State Journal of Medicine, March, 1917.

³ Indiana State Medical Association Journal, August, 1916.

Bismuth. It is now well recognized that bismuth may produce marked *poisoning*. In 1912 Mayer and Baehr¹ reviewed the literature of bismuth poisoning following the local application of bismuth to granulating surfaces. They found in the literature reports of 64 cases of poisoning with 24 deaths. Freilich² in reporting a case states that since the appearance of Mayer and Baehr's paper there have been reported 4 additional cases with two deaths. In his case the poisoning followed the injection of bismuth paste in the thigh. The symptoms in this case were characteristic, namely, sore gums, black pigmentation along the margin of the gums, the tongue was swollen and sore, pigmented spots in the buccal mucosa, salivation, diarrhea, and the presence of albumin and casts in the urine.

Anderson and Chambers³ have reported on the BISMUTH IODOFORM-PARAFFIN PASTE first used by Morrison in the treatment of *septic wounds*. Its composition is as follows: bismuth subnitrate 1 ounce, iodoform 2 ounces, and a sufficient quantity of paraffin. The consistency may be of any degree, but the most useful is that of soft butter and thick cream. In treating an infected wound the patient is anesthetized, all gangrenous and necrosed tissue is cut away, and the wound thoroughly cleansed. It is then swabbed out with alcohol and a small portion of the paste is vigorously rubbed into the tissues, a little being left in the bottom of the wound. The wound is then closed and dressed with gauze wrung out in alcohol. No further dressing is required for from seven to fourteen days. It is claimed that (1) the paste maintains a continuous antiseptic action in the wound; (2) it acts as a lymphagogue and a free exudation of serum washes the wound from within outward; (3) it does not prevent the escape of discharge; (4) granulation tissue grows freely in contact with it; (5) drainage tubes and gauze drains are unnecessary; (6) septic wounds heal nearly as rapidly as non-infected ones; (7) bone union is rapid and the tendency to form sequestra is slight.

Chambers and Goldsmith,⁴ in a bacteriological study of the effects of the paste, state that it seems clear that the bactericidal action results from the free iodine liberated from the oxidation of iodoform by oxygen and by the nitric acid formed by the hydrolysis of bismuth subnitrate. On this hypothesis it should be possible to reduce very largely the quantity of bismuth subnitrate and still obtain bactericidal action, provided oxygen is available, but in the absence of oxygen the reaction should cease, even with the usual maximum amount of bismuth subnitrate.

Anderson and Chambers⁵ treated 400 cases in this way and only 1 case of secondary hemorrhage occurred. No case of gas gangrene or tetanus developed since they have been using the paste; 1 case of iodoform poisoning occurred in the beginning when larger amounts of the paste were employed. In this case the symptoms of the poisoning were fever, delirium, and emaciation; they quickly subsided when the treatment was discontinued.

¹ Surgery, Gynecology and Obstetrics, 1912, xv, 309.

² Journal of the American Medical Association, January 13, 1917.

³ Lancet, March 3, 1917.

⁴ Ibid.

⁵ Loc. cit.

Blood Serum. The use of blood serum or whole blood is now a recognized procedure in the control of *hemorrhage* and in the treatment of severe *anemia*. A variety of sera have been used. Among them may be mentioned those from the rabbit, horse, various antitoxic sera, normal human blood serum, and whole blood (human). Oliver¹ believes that the simplest, the quickest, and the most efficient method is to obtain about 20 c.c. of blood from the vein of a healthy person and immediately inject it into the gluteal muscles of the patient. He states that these intramuscular injections are not painful, nor do they leave any bad results, as the blood is promptly absorbed.

Cross² states that while human serum or fresh human blood may be used subcutaneously without fear of anaphylaxis, the serum is ordinarily not at hand, save in large hospitals. In using fresh human blood one must always keep in mind the danger of lues. In the treatment of *hematemesis* he refers to the group of biological products of which horse serum is the type. This particular serum is very valuable in doses of 20 c.c. When repeated the possibility of anaphylactic phenomena supervening should be borne in mind.

Cross recommends, in place of horse serum, *coagulose*. This is a sterile soluble powder containing fibrin ferment from the horse, and can be obtained in the open market. In treating gastric hemorrhage the coagulose is dissolved in water at 98° F., and injected subcutaneously in doses of one ampoule of the original preparation in 15 to 120 c.c. of water. A second dose can be given in one or two hours, and in persistent hematemesis a daily schedule of three or four doses can be followed for several days. Cross states that its use is very advantageous, and there is this to especially commend it—it is readily obtainable in an emergency.

Holm³ has injected fresh human blood subcutaneously for a variety of conditions—hemorrhage of the newborn, hemorrhage from gastric ulcer, splenomyeloid leukemia, and pernicious anemia. He says that a fairly large amount of blood (4 to 8 ounces or more) may safely be injected into the subcutaneous tissues and perfect absorption takes place. Blood which is apparently toxic to the patient when used intravenously may be injected subcutaneously without causing any undue reaction.

A case of *horse asthma* treated by means of normal horse serum is reported by Zener.⁴ The patient had been, since childhood, subject to severe attacks of asthma whenever she came near a horse even for a few minutes. She was given 25 c.c. of horse serum intravenously. This induced an attack of asthma much more severe than that produced by contact with horses. Local applications of epinephrin solution (1 to 1000) were necessary to relieve the glottic edema. A mild attack of asthma followed exposure to horses shortly after. Three weeks after the first dose, 12 c.c. of horse serum were given intravenously and then doses of 25, 40 and 60 c.c. were given hypodermically, without any reaction.

¹ California State Journal of Medicine, January, 1917.

² Long Island Medical Journal, January, 1917.

³ Journal-Lancet, December 15, 1916.

⁴ Journal of the American Medical Association, March 17, 1917.

Zener reports that the patient was entirely cured and could ride and drive without suffering from asthma.

The danger of severe anaphylaxis in such a case would seem too great to justify one in resorting to this means of treatment. It is in just such cases that death has occurred from the injection of one of the antitoxic sera.

E. P. Robinson¹ recommends the use of horse serum in the treatment of *burns* as a means of producing epithelialization. The horse serum, containing a small percentage of tricoresol, was sprayed on the marginal skin cells and the parts thus treated were covered with rubber tissue. This was repeated several times a day for ten days and resulted in a complete recovery without complications, such as formation of pus or of proud flesh. Instead of requiring four or five months of treatment, as is usual in grafting operations, the patient was discharged from the hospital twenty-one days after her admission. Hess (see article on Kephalin) states that kephalin or thromboplastin has been used also to stimulate granulation tissue and hasten epithelialization.

Boric Acid. In the treatment of *furunculosis*, Bowen² advises the following procedure. He attempts to keep the skin as sterile as possible. In order to accomplish this the patient is directed to take a hot bath morning and evening, scrubbing the entire body, including the head, with soap. The skin is dried and then bathed in a saturated solution of boric acid in water. A small amount of camphor water may be added. The boric acid solution is allowed to dry on the skin. The clothing next the skin should be changed daily, and, in case of extensive *furunculosis*, the bed- and night-clothing should be changed also every day. Following the bath, morning and evening, the individual furuncles are dressed with the following ointment spread on cotton or gauze:

R—Boric acid	5j
Precipitated sulphur	3j
Carbolated petrolatum	3j
Mix.	

Bromides. Although it is clearly recognized that the bromides are only palliative remedies in the treatment of *epilepsy*, it is none the less true that they occupy a high place in the drug treatment of this disease. Admitting this, it is to be remembered that entire reliance on this method of controlling the disease is not to be desired. In the past, too much dependence has been placed on the bromides. Shanahan³ insists that epilepsy is a disease of the whole man and not of any one organ or system of organs. He emphasizes the necessity of moral treatment of epileptics in regard to self-control, personal discipline, and strict rules of conduct. The use of bromides may mask symptoms of the underlying causes of the disorder. This is particularly true in the case of patients who have paroxysms at long intervals, and, therefore, take an immense amount of bromide needlessly during the intervening periods. In a

¹ *Annals of Surgery*, March, 1917.

² *Boston Medical and Surgical Journal*, January 18, 1917.

³ *Medical Review of Reviews*, July, 1916.

later article, Shanahan¹ again emphasizes the necessity of carefully supervising the personal hygiene of the epileptic. For instance, unless the bromide is given in the form of *sulbromine*, *sedobrol*, or some other of the more elegant preparations, great care must be exercised to give the bromide salt in solution following meals and well diluted. While the ordinary epileptic is prone to suffer from constipation, the one under bromide medication has a special tendency toward this symptom; therefore, laxatives, colonic flushings, etc., must be freely resorted to. Frequent bathing is also essential in order to keep the skin functioning properly. In addition, proper care of the mouth, teeth, etc., is of the utmost importance. As a result of the careful attention given to the general health of the patient, Shanahan has shown that the amount of bromides can be markedly reduced, and at the same time the number of fits is lessened.

At the Craig Colony for Epileptics during several years past there has been a marked reduction in the quantity of bromides used in the treatment of its patients, as is shown in the accompanying table.

Population of colony by years.		Dosage—Ounces of bromides and other bromide-containing compounds per patient yearly.	Average number of seizures per patient.
1902,	764	10.8 ounces	98
1903,	824	12.5 "	124
1904,	836	15.6 "	124
1905,	992	10.8 "	146
1906,	1046	12.2 "	136
1907,	1054	5.7 "	128
1908,	1160	8.8 "	127
1909,	1273	3.0 "	113
1910,	1330	.28 "	110
1911,	1381	1.7 "	106
1912,	1433	.1 "	115
1913,	1434	.4 "	104
1914,	1428	.87 "	105
1915,	1450	.45 "	95

Among the bromide preparations used were the various bromide salts, potassium, sodium, and ammonium, bromopin, brometone, sabromin, sedobrol, etc. The patients under treatment are epileptics of all ages from infancy to the advanced senile period, the majority being young adults. The duration of epilepsy in those under treatment varied from a few months to a great number of years, the majority being several years. Both sexes were under treatment; there was a slightly greater number of males than females. It will be observed that while the average dosage of bromide used was materially lessened, the average number of seizures did not increase, as might be expected. A very considerable percentage of the patients had a well-defined organic epilepsy, the others what we still term in our lack of knowledge as "idiopathic." Chloral hydrate, amylene hydrate, hyoscine hydrobromide, and other sedatives have been made use of at the Colony, but for only acute phenomena—*e. g.*, status epilepticus, or serial seizures—and not administered regularly.

¹ Therapeutic Gazette, November, 1916.

over a considerable period as is done with bromides. It is of interest to note that with the lessened administration of various preparations of bromine there has been no increase in the average number of seizures per patient, but, on the other hand, there has, on the whole, if anything, been a slight lessening in the number, the conclusion being that the general readjustment of every possible phase of the epileptic's life is of more importance than the indiscriminate use of sedation.

Drug eruptions are always interesting because of the resemblance they sometimes bear to the acute eruptive fevers. Among the drugs which are particularly prone to produce skin eruptions are the bromides. The most common manifestation is the familiar *acne* eruption, which often follows even small doses of one of the bromides. Lane¹ reports a very severe and unusual form of eruption following the use of potassium bromide and potassium iodide. A baby, aged five months, had been given 8 grains of potassium bromide daily for three weeks, and, for the last week, 4 grains of iodide of potassium. The eruption was very severe, and consisted of about twenty vegetating, somewhat condylomatous growths circular or polycyclic in outline. They were located on the face and forehead. The larger ones were evidently formed by smaller ones, having grown together as they extended. They varied from 0.5 to more than 6 cm. in diameter, and the largest were elevated 2 cm. above the surface of the skin. Their color varied from nearly that of arterial to that of venous blood, and they frequently bled. On the buttocks there was a discrete vesicular eruption, more nearly of the usual type of bromide eruption. Later a secondary eruption occurred on the face which might easily have been mistaken for chicken-pox.

Bromoform. This substance has been recommended for some years in the treatment of *whooping-cough*. In common with numerous other remedies employed in the treatment of this disease, it has been quite as often a disappointment as a success. Kitchens² believes bromoform will often prove of service if it is given properly. He advises 1 drop of bromoform for each year up to five; 5 drops is the maximum dose for five years and upward. Give this dose three times during the day and once during the night. Fill a teaspoon two-thirds full of simple syrup, drop in the dose, stir it into the syrup with a glass rod or a toothpick and give at once. Every dose should be mixed immediately before giving. As the drug is inflammable it should not be exposed to an open flame.

Bulgarian Bacillus. The use of lactic acid bacilli in the treatment of *infantile diarrhea* is the subject of an article by Gray.³ He has treated successfully within the past two years 87 cases of fermentative or putrefactive diarrhea in children. Before administering the bacilli tablets he resorts to mild purgation with calomel, especially if the child has fever.

If it is necessary to employ a pure, viable culture of type "A" *Bacillus lactic acid bulgaricus*, care must be taken to keep the bacilli viable.

¹ Journal of the American Medical Association, June 9, 1917.

² Therapeutic Gazette, December, 1916.

³ Memphis Medical Monthly, October, 1916.

From the time the cultures leave the laboratory until they are administered to the patient they should be kept in a temperature of not exceeding 60° F., except for the short time while in transit. This can be done by purchasing from a dispenser, who keeps them in a refrigerator, and by directing that they be kept in a refrigerator in the home.

Gray quotes Clark as to the most impressive facts in this method of treatment:

1. The gain in weight, in spite of the number of stools.
2. The rapid change of color of stools.
3. The rapid subsidence of fever.
4. The absence of mucus and blood from the stools at the end of forty-eight hours.
5. The fact that the hygienic surroundings of the patients and the degree of intelligence of the mothers had no influence on the results.
6. A starvation diet, accompanied by purgation, is productive of loss of weight and strength, and serves to prolong the course of the disease.
7. In severe cases the best results are obtained by administering a large number of tablets during the first two or three days of the treatment, as many as 42 Bulgarian tablets in twenty-four hours having been given to very young babies without untoward effects.
8. The implantation method of treatment has progressed beyond the experimental stage, and the result of its use can no longer be questioned or disputed. This treatment has proved of practical, clinical, and scientific value, and its simplicity should appeal to every practitioner.
9. In order to secure the best results in using the implantation treatment a pure culture of the true *Bacillus lactic acid bulgaricus* must be employed, otherwise disappointment will follow.

Caffeine. Several metabolism studies have been made on the effect of the ingestion of caffeine. Means, Aub, Du Bois, and Soderstrom¹ studied the effect of the drug in 4 normal subjects, after the administration of 8 to 10 grains of caffeine alkaloid (8.6 mg. per kg. of body weight). There was no significant change in the pulse rate, in the respiratory quotient, in the proportions of the various foodstuffs metabolized, or in the percentage of heat lost in the vaporization of water.

Mendel and Wardell² have studied the effects of coffee and tea used as a beverage. They found that the ingestion of these substances or of caffeine when added to a purin-free diet causes a marked increase in the excretion of uric acid, and this seems to be proportional to the quantity of caffeine ingested.

Camphor. This drug is one of the recognized cardiac stimulants, especially when it is necessary to obtain such an action rapidly. Under these circumstances it is usually given subcutaneously in the form of camphorated oil. Marfan³ states that it can be given in pill or other form by mouth; it is well borne and may have a useful influence on the digestive tract. He regards it as useful for dilating the vessels and

¹ Archives of Internal Medicine, May, 1917.

² Journal of the American Medical Association, June 16, 1917.

³ Policlinico, June 17, 1917; Journal of the American Medical Association, August 4, 1917.

reducing the blood-pressure both in the greater and the lesser circulation. Nothing, in his opinion, can compare with camphor to stimulate the heart and regulate the pulse in cases of chronic myocarditis with simple cardiac insufficiency, with arrhythmia, or with auricular fibrillation. The drug should be given over long periods. It seems to exert its chief influence on the right heart, and is, therefore, especially indicated when the predominating disturbances are hypertension in the right ventricle and lesser circulation.

Chaulmoogra Oil. For years this drug has been more or less the standby in the treatment of *leprosy*. The great difficulty has been the inability of the patient to take it by mouth. In some instances it could not be tolerated at all; in others it had to be discontinued because of the intolerance of the stomach. To overcome these objections, Heiser¹ devised a formula which could be given hypodermically. His very favorable results have been reviewed in *PROGRESSIVE MEDICINE*, December, 1915. The formula used by Heiser is as follows: Chaulmoogra oil, 60 c.c.; camphorated olive oil, 60 c.c., and resorcin 4 gm. The mixture is sterilized. The injections are started with 1 c.c. of the mixture, repeated at weekly intervals. After three weeks the dose is gradually raised until 3 c.c. are injected each week. After the first injection there is nearly always a slight reaction, which begins a few hours after the injection and lasts until the next day. The reaction consists of a slight headache, malaise, and a suggestion of nausea. Reactions do not follow the first injection. The weekly injections may be continued for months.

Bercoritz² has reported 14 cases treated by this method. He has summarized his results as follows:

1. The chaulmoogra oil formula used by Heiser is effective in the treatment of leprosy.
2. The hypodermic use of this formula is a satisfactory method of administering the drug.
3. The tubercular forms of leprosy respond to the treatment earlier than the anesthetic forms.
4. Anesthetic areas in both types of the disease have become hypersensitive, with improvement, and some of the patients report the return of tactile sensation.
5. Under this treatment large ulcers have healed with the formation of clean, white scar tissue.
6. Sections from 2 cases showing marked clinical improvement have shown fibrosis of the lepra nodule; sections from 1 case with very slight clinical improvement showed a typical leproma.

Gynocardic acid and *chaulmoogric acid* are synonymous. Rogers³ reports 9 cases of leprosy treated with *gynocardate of soda*. The drug is administered hypodermically. Of the 9 cases, 5 were of the anesthetic and 4 of the tubercular type of leprosy. The results obtained in the anesthetic cases were very encouraging. The tubercular cases

¹ Supplement 20, Public Health Reports, October, 1914.

² Journal of the American Medical Association, June 30, 1917.

³ British Medical Journal, October 21, 1916.

responded more slowly, and there was greater local pain and induration at the sites of the injections. Rogers begins with $\frac{1}{10}$ grain of the drug and increases by $\frac{1}{10}$ grain at each successive dose, using a 2 per cent. solution. As much as $\frac{1}{5}$ grain has been given with no immediate effect or any sign of toxic influence, apart from local reactions and fever, and, rarely, some headache. Rogers has substituted intravenous injections for the subcutaneous method.

Chenopodium. In the treatment of *carriers of the Entameba histolytica*, Walker and Emrich¹ have obtained encouraging results from the use of the oil of chenopodium. Of 14 carriers treated by them, 10 were apparently cured and 4 remained uncured. They believe that the 4 failures might have been avoided if it had been possible to administer the treatment satisfactorily, especially with reference to the preliminary purgation and continuance of the use of the chenopodium.

The dosage employed in the successful cases was 16 minims; in 2 cases two doses were sufficient; in the remaining 8 cases three doses were given. They believe the preliminary purgation with magnesium sulphate is of even more importance than the chenopodium. The purpose of the preliminary purgation is twofold, first to remove the excess of fecal matter from the intestine which envelops and protects the entamebas and dilutes the chenopodium, and, second, and most important, to bring the entamebas out of their protective cysts and subject them in the vegetative condition to the action of the chenopodium. Their experiments showed that this preliminary purging, which should not merely consist of the routine administration of the salts, but should also secure free fluid bowel movements before the chenopodium is given, to be the most essential factor for successful treatment. Another important point is that the chenopodium must be administered while the stools are fluid, that is, at a short interval (two hours) after the purgation, in order that it may reach the entamebas while they are still in the vegetative stage. The effect of the drug should be checked up by examination of the stools at intervals following the treatment.

Walker and Emrich recommend the following method: (1) magnesium sulphate, from $\frac{1}{2}$ to 1 ounce, at 6 A.M.; (2) oil of chenopodium, 16 minims in gelatin capsules, at 8 A.M., 10 A.M., and 12 M.; (3) castor oil, 1 ounce, containing 50 minims of chloroform, at 2 P.M. This dosage is for adults; for children it should be reduced according to the age.

In the treatment of *hookworm disease*, Billings and Hickey² prefer oil of chenopodium to thymol. In their opinion the chenopodium gives markedly better results, and its value is further enhanced by the fact that not only is it followed by fewer disagreeable after-effects, but with its use no dietetic precautions need be exercised either before or during its administration.

Their routine treatment in hookworm disease is as follows: Preparatory treatment: at 7 A.M., magnesium sulphate, saturated solution,

¹ Journal of the American Medical Association, May 19, 1917.

² Ibid., December 23, 1916.

60 c.c. is given. At 7 P.M., sodium sulphate, saturated solution, 90 c.c. The next morning chenopodium is commenced, proceeding as follows:

- 7.00 A.M., oil of chenopodium, 15 drops.
- 9.00 A.M., oil of chenopodium, 15 drops.
- 11.00 A.M., oil of chenopodium, 15 drops.
- 1.00 P.M., castor oil 18 c.c., choloform 2 c.c.
- 1.30 P.M., plain castor oil, 30 c.c.
- 2.00 P.M., a cup of hot tea.

They administered the oil on sugar rather than in capsules.

The dosage of oil of chenopodium from six to seven years is 5 drops; from seven to nine years, 7 drops; from ten to eleven years, 10 drops; from twelve to fifteen years, 12 drops; sixteen years and over and under 60 years, 15 drops. The drop dose of chenopodium is measured from an ordinary medicine dropper, which equals about 3 drops to 1 minim; 15 drops equal approximately 6 minims.

In regard to the use of chloroform in the castor oil, Billings and Hickey state that the former seems to have a marked synergistic action, as giving chenopodium and omitting chloroform from the castor oil has been tried, but with inferior results. On the other hand, they believe that the amount of chloroform usually recommended (3 c.c. to a table-spoonful of castor oil) is too large. In their experience this dose of chloroform was followed in a considerable percentage of cases by vertigo and stupor, and several times by temporary deafness, which lasted for two or three days. They found that a smaller dose of the chloroform was equally efficacious, and in addition eliminated the danger of untoward symptoms.

Hall and Foster¹ state that oil of chenopodium has a very high coefficient of efficacy against *ascarids*, and among the things which they tried it was found more effective in a single therapeutic dose against these worms than any other drug. Furthermore, its efficacy against ascarids proved greater than that of any other drug against various other parasitic worms with which we experimented. It should be given with castor oil and followed by castor oil, the drug being administered on an empty stomach, in order to secure the best results and to give the patient the maximum amount of protection from the local and systemic effects of the drug. These authors state that *chloroform* has a higher coefficient of efficacy against hookworms than oil of chenopodium or any other drug with which they experimented. They summarize their experimental findings as follows:

"Our experimental findings indicate that oil of chenopodium should be accompanied by large doses of castor oil, and that when so given it is an uncommonly effective and quite safe anthelmintic for use against ascarids. Chloroform in castor oil, in therapeutic doses, is the most effective anthelmintic we have found for use against hookworms, and we consider it as safe as thymol or any other effective drug for use against hookworm disease."

¹ Journal of the American Medical Association, June 20, 1917.

POISONING FROM OIL OF CHENOPODIUM, while not a frequent accident, does occasionally occur. Motter¹ states that toxicologically a search of the *Index Catalogue* and the *Index Medicus* reveal but 12 published cases of poisoning by wormseed oil in something over fifty years. Of these, 8 were fatal. All of the reported cases, however, show a certain general similarity, indicating that the toxic action is exerted particularly on the central nervous system.

Contant,² among 300 cases of hookworm disease, observed 1 case of poisoning from the use of oil of chenopodium. His case was a young man suffering from severe uncinariasis. Following the second dose of the oil (20 minims in all), he was suddenly seized with severe, gripping, cramp-like pains in the abdomen, vomiting, intense backache, and nervous twitchings and tremors of the extremities. His temperature rose to 102° F., with sweating. The nervous condition progressed in a short time to a state of nervous prostration, and the patient became hysterical and was irrational for several hours. The extremities were cold and clammy, the pulse shallow and rapid, and the heart sounds weak. As the result of stimulation (strychnin, digitalis), he rallied. The following day he had a similar, but milder, attack. Later, he recovered. Contant quotes Levy's study of the literature on poisoning from oil of chenopodium. Levy's article³ was reviewed in *PROGRESSIVE MEDICINE* several years ago, but his results will bear repetition. Up to the time he made his study (1914) there had been 12 cases of poisoning in this country. Nine of the patients died in from two to five days. Eight of the cases were in children under thirteen years of age. The smallest dose given in these cases was 30 minims at one time to a patient of ten years, who recovered, and 4 drops three times a day for two and a third days (28 drops in all) to an infant of one year, which was fatal.

It is quite possible that the drug has a cumulative action, and, should this occur, or an idiosyncrasy be manifested, free purgation and stimulation with hot coffee should be instituted at once (Billings and Hickey).

Coley's Fluid. In cases of inoperable malignant disease, particularly *sarcoma*, the use of Coley's fluid should be borne in mind. Barss⁴ reports 4 cases of inoperable sarcoma in which excellent results were obtained. The first case, one of inoperable sarcoma of the antrum, was first unsuccessfully treated by the röntgen rays; there was no recurrence twenty months after the use of Coley's fluid. The second case, sarcoma of the head of the humerus, was apparently cured. The third, sarcoma of the femur, was greatly improved, and later operated on. The fourth case, sarcoma of the tibia, was given great relief, and, although recurrence has taken place, the general health of the patient has been markedly improved.

Extract of Corpus Luteum. In *PROGRESSIVE MEDICINE* for December, 1916, we reviewed a preliminary report by J. C. Hirst on the use of corpus luteum extract in the control of the *nausea and vomiting* of

¹ Quoted by Billings and Hickey, loc. cit.

² Journal of the American Medical Association, November 25, 1916.

³ Ibid., November 28, 1914.

⁴ Michigan State Medical Journal, October, 1916.

pregnancy. Hirst¹ has, during the past year, published a second paper. The total number of cases now reported is 36, and of this number 32 have been successful. Hirst injects the extract intramuscularly.

The material used is in ampoules, containing $\frac{1}{2}$ grain of soluble corpus luteum powder in 16 minims of physiological salt solution, saturated with chlorbutanol for its local anesthetic effect. This amount is equivalent to $2\frac{1}{2}$ grains of desiccated corpora lutea.

In several hundred injections there has not been a single abscess. There is sometimes a red area around the side of the injection, for twenty-four hours, which is slightly tender, and this is less common the deeper the injection is given. A compress of alcohol and water, equal parts, promptly relieves this. Except in 1 case there has been no general reaction and no anaphylaxis. The reaction in the case mentioned was of short duration, and occurred in a person evidently markedly susceptible. Not one of the patients aborted. This is somewhat remarkable. With the normal ratio of 25 per cent. it would not have been unusual if 6 had done so. Theoretically, at least, there should be some risk of abortion in the use of luteum extract, but the facts do not confirm the theory. At the very least it can be stated definitely that the method does not add to the risk of abortion.

Another curious fact is the sedative action in markedly neurasthenic cases. Not only was the nausea improved, but also the patients' nervous phenomena. The dizziness, headache and other nervous manifestations of early pregnancy seemed to be remarkably controlled.

The percentage of success in this series (88) coincides with that of the preliminary report (80). As the cases were not selected, but taken consecutively, Hirst can see no reason why the results in a much larger number should vary far from this. It is too much to claim, in a subject so complex as the nausea of pregnancy, that any single agent should prove specific. Based on the foregoing results, however, it seems justifiable to assert that here is an important factor which heretofore has not received the attention it deserves.

There is considerable discussion at the present time as to the effects of the extract of the total ovarian substance versus the extract made from the corpus luteum alone. Graves² has found the extract of the whole ovary more efficacious in the treatment of *functional amenorrhea* than the extract made from the corpus luteum. He also believes that extract of the luteum is more prone to disturb the digestion, while ovarian extract is seldom toxic.

Rabinovitz³ believes that the physiological and therapeutic functions of the extract of corpus luteum and the extract made from the whole gland are different. He suggests that the whole gland be used in cases of hypövarianism, including amenorrhea, sterility, infantilism, certain forms of dysmenorrhea, and metabolic dyscrasias in which ovarian insufficiency is present. He recommends the extract of corpus luteum in two very dissimilar conditions: (1) cases of hyperovarianism, includ-

¹ Journal of the American Medical Association, December 16, 1916.

² New York State Journal of Medicine, 1916.

³ American Journal of Obstetrics, 1916.

ing functional menorrhagia, increased sexual appetite, and osteomalacia; and (2) the nausea and vomiting of pregnancy and other forms of toxemia of pregnancy, eclampsia, etc.

Happel¹ summarizes its uses as follows: Extract of corpus luteum must be given over a long period of time, and in sufficient dosage according to the needs of the patient. It produces no toxic effect, except a feeling of fulness of the head or vertigo, and is not cumulative. It is the best remedy for the relief of the nervous symptoms of the *natural menopause* and for their prevention and relief in *postoperative menopause*. It is of the greatest value in the treatment of *irregular or scanty menstruation* in young women, and alleviates the neurasthenic symptoms so often associated. It relieves *dysmenorrhea* in young girls and nulliparae not due to a pathological lesion. Benefit in nausea and vomiting of pregnancy has been reported. The only disadvantage is the cost, which precludes its use in many cases where it is strongly indicated.

Novak² has made a clinical and histological study of 137 cases. He states that a careful analysis has failed to reveal anything like a direct relation between the degree of lutein development in the ovary and the clinical intensity of the menstrual flow. Speaking generally, the corpus luteum from a case of excessive menstruation shows no greater development than that from a case of scanty menstruation at a corresponding stage in the menstrual cycle. Such a conclusion is not justified unless both ovaries are thoroughly examined in all parts, so that no lutein tissue structures will be overlooked. This was done by Novak in 102 cases, and it is on this data that he bases his conclusion that variations in the amount of menstrual flow are not due to differences in the degree of development of the lutein tissue of the ovary. This does not, however, preclude the possibility of functional increase or decrease being the cause of increase or decrease in the menstrual reaction. Novak points out that even though the ovarian secretion is the immediate cause of menstruation, this function is also influenced by practically all the other endocrine glands of the body. The ovary is merely the portal through which the entire ductless gland exerts its influence on the functions of the female generative organs. Whereas formerly anatomical causes were presupposed in practically all cases of uterine bleeding, now the evidence is pointing more and more clearly toward the importance of functional disturbances in the ovary and of the endocrine system, of which it is a part. To this general principle the bleeding caused by such actually destructive lesions as cancer is, of course, an exception.

Cyanocuprol. A year ago much interest was aroused over the claims of Japanese investigators as to the specific properties of cyanocuprol in the treatment of *tuberculosis*. The articles of Otani and Koga were reviewed in *PROGRESSIVE MEDICINE* for December, 1916. Recently, Otani³ has contributed another article on this subject, in which he gives in detail the precautions necessary to carry on the treatment with this

¹ Medical Record, May 19, 1917.

² Journal of the American Medical Association, October 28, 1916.

³ New York Medical Journal, March 24, 1917.

substance. He believes that each organ reacts differently to the drug and that the dose must be determined according to the sensitiveness of the organ most affected.

It may be stated that up to date the claims made for cyanocuprol have not been substantiated by other observers.

Cymarín. This drug is the active principle of apocynum. Robert Abrahams¹ states that cymarín frequently gives surprisingly good results in that form of *dropsy* due to kidney and heart disease. The dose of cymarín is $\frac{1}{200}$ of a grain. It is prescribed in silver-coated pills or ampoules; the latter are used in emergency and hypodermically. One pill may be given every four hours until the desired effect is produced.

Diet. The threatened shortage in the world's food supply has brought forward most emphatically the importance of a knowledge of food values and of dietetics in general. There is no subject upon which the general public is so poorly informed as that of food values, and, one must admit, the great majority of physicians are equally ignorant. One hears a great deal about caloric values, but there are very few physicians who can translate these values into a language that is readily comprehended by the layman.

In commenting on this subject editorially the *Journal of the American Medical Association* (June 9, 1917) states that the requirements of the body, as expressed in units of food fuel, are beginning to be better understood both by the professions which have to deal with diet and by the laity: "It would be an exaggeration to say that many persons are qualified to speak of daily food in terms of calories as they discuss gallons of gasoline or tons of coal in connection with other affairs of daily life. But there are signs of a more tolerant attitude toward the new language in which human dietary needs are best expressed. The exigencies of the present moment have served to focus attention more firmly than ever on what the nutritive needs of living bodies really involve." A marked advance in this direction has been made by Emerson, of Boston. He has adopted the suggestion of Irving Fisher and reduced all articles of diet to a common unit, 100. For example, one glass of milk, one medium-sized egg, one roll, three "Uneeda" biscuits, one quart of bouillon, two tablespoonfuls of baked beans, eight tablespoonfuls of string beans, one lamb chop, etc., each equal 100 calories. In addition the proportion of protein, fat, and carbohydrate is indicated for each of these articles. One of the difficulties of teaching caloric values has been the burden to the memory involved in remembering the exact value of each article. While the method of Emerson is only approximately correct, it is sufficiently accurate to give one a fair estimate of how much food is being taken. Emerson has used the method with great success in treating delicate, undernourished children, and has had no difficulty in teaching them not only the kinds of food most desirable, but the amounts necessary for them in twenty-four hours. For this purpose he has had prepared a small

¹ Therapeutic Gazette, July, 1917.

food exhibit in which each of the commoner articles of diet each represent 100 calories. I have had a similar exhibit made for the Phipps Institute and found it most valuable for teaching purposes both for patients and medical students.

The necessity of spreading a knowledge of food values among the working classes was clearly brought out by a study made at the Phipps Institute by Craig and myself.¹ In this investigation we studied 12 families representing four nationalities—three Italian families, three Russian-Jewish families, three negro families, and three Polish families. Each family was reduced to a common unit, representing men at moderately hard work. This was done by the following method: The total number of "men" in each family was estimated according to Atwater's scheme. Thus, a family consisting of a man at hard muscular work (1.2), a woman at moderately active work (0.8), a boy of twelve years (0.7) and a girl of ten (0.6) would be reckoned as a family of 3.3 "men." If a family like that just mentioned was found to have a dietary which provided 9900 available calories daily the family would be considered as having a dietary of 3000 calories per man per day. This method of estimation is described in detail to avoid any possible confusion in regard to either the actual number of individuals in the family, or the number of calories which each member of the family received daily.

It was then determined how much each family spent per man on food. Before beginning the study the nurse went to the home with a pair of scales and took a careful inventory of all the food on hand. This was weighed and the family purchases for two weeks were also weighed and reduced to calories. At the end of the experiment the amount remaining on hand was subtracted. In this way we were able to obtain a fairly accurate idea of the amount of food consumed by each family and also the cost of the food for each family. The following table shows what it cost each family per man per day and also the character of their diet.

Race.	Total calories.	Protein calories per man per day.	Proportion of protein calories. Per cent.	Proportion of carbohydr- ates. Per cent.	Proportion of carbohy- drate calories. Per cent.	Cost of food per man per day
Italian	2600	297.2	11.0	19.5	69.4	\$0.1910
Jewish	2639	350.6	13.3	27.6	59.0	.2409
Polish	3123	432.8	13.8	30.6	55.5	.3469
Negro	2947	322.7	10.9	41.3	47.7	.2215

A comparison of the average composition of the food for each race shows that one of the chief differences between the dietaries consists in the variation in the relative proportion of fat and carbohydrate, the proportion of protein calories showing only a slight variation. It may be worth noting, however, that there was a constant relation between the number of protein calories and the cost of food per man per day.

In the Italian families the proportion of fats consumed was the lowest and the carbohydrates the highest of the races studied. The negroes gave the highest proportion of fats and the lowest carbohydrate, the other two races being almost midway between the Italians and negroes.

¹ Transactions Association of American Physicians, 1916.

From the study of the 12 families investigated one would seem justified in drawing the following conclusions:

The average dispensary family obtains about four-fifths of the nourishment it should receive.

Ignorance of the nutrient value of food and poor judgment in its purchase is the main cause of this state of affairs, although poverty is to a certain extent also responsible.

Education of the poorer classes in dietetics and food economy would undoubtedly, if made sufficiently wide-reaching, lead to a marked improvement in their nutrition and general well-being.

A somewhat similar study has been made by Lucy H. Gillett¹ for the New York Association for Improving the Condition of the Poor. The statistics collected in this survey of food allowances for healthy children represent the indications furnished by three independent types of investigation, namely: (1) dietary or observation studies in which the weight of the food eaten by the subject was recorded for a given period of time, and the food values either determined by analysis or more commonly calculated from figures representing average composition; (2) metabolism or balance experiments in which the intake and output were compared by determining clinically the composition of both the food eaten and the excretory products, thus showing the amount of nitrogen retained in the body for growth of protein tissue; (3) respiration experiments in which the actual heat produced by the body was either measured directly in an air-tight chamber impervious to heat or calculated from the amount of oxygen consumed and the carbon dioxide exhaled.

The averages attained from the available data furnished by these three methods of approach are summarized as follows:

CALORY REQUIREMENT OF CHILDREN AT DIFFERENT AGES.

Ages, years.	Calories.	
	Boys.	Girls.
From 2 to 5	1309	1245
From 6 to 9	1797	1575
From 10 to 13	2337	2015
From 14 to 17	2534	2253

It will be noted that the requirements of the two sexes differ. Differences in size at the same age seem less likely "than the assumption of unlike bodily activities, on which a part, at least, of the different needs depends."

It is often lost sight of that a growing child requires more food proportionately than an adult. In addition, Gillett has pointed out that greatly emaciated children with depleted tissues, which can and ought to be rebuilt rapidly, should receive a more liberal food allowance than would be required by normal children either of the same age or of the same weight.

¹ Publication 115, 1917; editorial, *Journal of the American Medical Association*, June 9, 1917.

The standards set by this survey are shown in the following table:

FOOD ALLOWANCES FOR CHILDREN.

	Age, years.	Calories per day.	
		Boys.	Girls.
Under 2	2	900 to 1200	900 to 1200
From 2 to 3	3	1000 to 1300	980 to 1280
From 3 to 4	4	1100 to 1400	1060 to 1360
From 4 to 5	5	1200 to 1500	1140 to 1440
From 5 to 6	6	1300 to 1600	1220 to 1520
From 6 to 7	7	1400 to 1700	1300 to 1600
From 7 to 8	8	1500 to 1800	1380 to 1680
From 8 to 9	9	1600 to 1900	1460 to 1760
From 9 to 10	10	1700 to 2000	1550 to 1850
From 10 to 11	11	1900 to 2200	1650 to 1950
From 11 to 12	12	2100 to 2400	1750 to 2050
From 12 to 13	13	2300 to 2700	1850 to 2150
From 13 to 14	14	2500 to 2900	1950 to 2250
From 14 to 15	15	2600 to 3100	2050 to 2350
From 15 to 16	16	2700 to 3300	2150 to 2450
From 16 to 17	17	2700 to 3400	2250 to 2550

An important feature of this survey is the emphasis that is laid on determining the amount of food needed for the different types of individuals. Thus a small, inactive man may require less than a large active boy or girl. If a child is tall and growing rapidly at six years of age, he may, and probably will, require 1600 calories; if of smaller frame, an allowance of 1400 to 1500 calories may be sufficient; while if both large and active for his age 1700 calories may be needed. This, I believe, is an important point. For years I have combated the idea that all individuals irrespective of age, sex, and type of physique, should be placed on the same quantity of food. In many institutions for the treatment of tuberculosis a fixed standard for all patients is common. I never could see that a six-foot man of large frame should be placed in the same class as a small woman insofar as food requirements are concerned. It is to be hoped that observations such as those just quoted will serve to bring about a more rational idea as to food requirements.

In this connection it is interesting to note an article by Ruiz,¹ Chief of the Department of Food Hygiene in the National Public Health Service of Argentina. He emphasizes the fact that a laboring man in the tropics does not need as much by 500 calories as in the temperate zone. His food should be rich in carbohydrates, scanty in fat, and moderate in proteins. That ignorance of food values is world-wide is shown by the statement of Ruiz that laborers in his country at present have no idea of thrift and hygiene, and that the State should make laws to ensure their getting proper food.

Another phase of the food problem, which is much neglected in this country, is that which has to do with the care and protection of *perishable foodstuffs*. Although this is properly a question of public health administration it may not be amiss to allude to it here. In the majority of our municipalities little attention is paid to supervising the care of perishable foods, with one exception, namely, milk. In practically all other instances little is done.

¹ *Semana Medica*, Lima, 1916, No. 52.

Two years ago the Phipps Institute, in association with the Bureau of Municipal Research,¹ made a survey of conditions in Philadelphia. The conditions under which perishable foodstuffs were handled was extremely bad, although it is only fair to say that Philadelphia is not unique in this regard. Similar studies in other cities and towns would probably reveal much the same condition.

The solution of this problem is an adequate inspection service, and, above all, one that is untrammelled by political restrictions. Like so many other of our public health problems it is one of dollars and cents. Nothing can be accomplished in public health work without an adequate budget. The difficulty in Philadelphia is shown in the following table, in which is shown the money spent for service of this kind.

Philadelphia in her expenditures for food inspection compares most unfavorably with other large cities, viz:

New York	whose per capita expenditure is \$0.03
Baltimore	" " " .05
Chicago	" " " .05½
Boston	" " " .07
Pittsburgh	" " " .10
Philadelphia	" " " .01½

The budget of the Department of Health must be made adequate to the needs of the community. It is worth mentioning at this point that the neglect of the perishable food problem in Philadelphia is, to a great extent, if not entirely, due to lack of money. Of six of the leading cities in the country, Philadelphia stands last, with an expenditure of \$0.0166 per capita as compared to Pittsburgh with \$0.0999 per capita. As a result, Philadelphia has the fewest and the most poorly paid inspectors in this group of cities. As the Bureau of Municipal Research has pointed out, if Philadelphia were to pay five cents (\$0.05) per capita for food inspection less than the average of these other cities the total appropriation would be \$82,500 as compared with the present \$27,352.

The need of supervision over those who handle foodstuffs is well illustrated by the danger a *typhoid carrier* often proves to be. Recently another source of danger came to my attention: A man employed in a bakery was referred to me for admission to a sanatorium of which I am an examiner. This man had advanced tuberculosis of the lungs. He came from the resort at which I am spending my summer and worked in the bakery from which I obtained my bread. Sooner or later there must be, and will be, laws enacted which make it compulsory for all those employed in the handling of foodstuffs to undergo a medical examination to determine their physical fitness for such work.

VITAMINES AND ACCESSORY FOOD SUBSTANCES. The recent advances in our knowledge as to the clinical composition of foods have thrown a great deal of light on what has been known empirically for years. The knowledge that subsistence on certain diets, especially those with an absence of fresh fruit or vegetables, often lead to the development of scurvy, is centuries old. In this connection, Bayliss² quotes an interest-

¹ Twelfth Report of Phipps Institute, 1916.

² Principles of General Physiology, 1915.

ing observation from Captain Cook's account of his second voyage. Although this voyage lasted one thousand days he was successful in preventing the appearance of scurvy among his crew. He says (1776): "We came to few places where either the art of man or nature did not afford some sort of refreshment or other, either of the animal or vegetable kind. It was my first care to procure what could be met with of either by every means in my power and to oblige our people to make use thereof, both by my example and authority; but the benefits arising from such refreshments soon became so obvious that I had little occasion to employ either the one or the other."

I am indebted to Gordon J. Saxon for the following brief account of these important substances: One of the most interesting additions to our knowledge of nutrition has been made within the last six years—as to the way the "accessory food substances" of Osborn and Mendel and the substances named "vitamines," by Casimir Funk, act. The part played in nutrition by fats, proteins, and carbohydrates, together with adequate salts in proper proportions, is now common knowledge. It has not been known very long, however, that if a growing animal that is developing on a given diet be fed on that same diet purified, all growth will cease. That is, if the fat be pure fat, with no contaminating products, and the same degree of purity be made to prevail with the proteins and carbohydrates there can be no growth. Osborn and Mendel have maintained white rats without growth on such diets for five hundred days.

Saxon, in the early days of this experimental work, was interested in attempting in his laboratory to duplicate the results of Mendel and Osborn. His efforts in this direction were eminently successful for about two months, when suddenly the animals began to grow. An effort was made by everyone concerned to determine the reason for the change in the weight-curve of this particular litter. After several days it was discovered that the technician who had the preparation of the diets in charge was using commercial sugar of milk instead of recrystallized lactose, with which the experiments had been begun. The commercial sugar of milk which was thus erroneously employed was a high-grade product, and the contaminating substance that was instrumental in causing growth was present in such small amounts that it could have had no nutritive value in itself. It was present, however, in a quantity sufficient to enable the animals of the litter to utilize the food units of their purified diet in such a way as to permit of their rapid growth. After the use of the commercial sugar of milk in this experiment was discontinued and a recrystallized product again employed, growth ceased and the weight of the litter, as a whole, again took on a stationary phase and remained so for two months.

It is the deficiency of the accessory food substances in polished rice (rice that has had its endocarp polished off) that causes beri-beri in people who subsist on such rice solely. If to such a diet extracts of rice polishings be added, beri-beri, or polyneuritis, will not develop; or if already present will be cured. In addition it has been shown experimentally that fowls fed on polished rice develop a polyneuritis similar to

that occurring in beri-beri. If unpolished rice be fed or the removed portion be added to the polished rice the birds remain healthy. Furthermore, the addition of the removed portion of the rice to the diet quickly cures the polyneuritis. The protective substance contained in the pericarp is destroyed by heating to 120° for two hours. Pellagra is now thought to be one of these deficiency diseases—diseases due to a dietetic deficiency. Cooking foods under pressure will destroy these accessory substances.

Cod-liver oil is especially high in vitamins, and it is probably because of its high content of these substances that it possesses special nutritive potency. It has long been known that cod-liver oil does possess such a potency, and the physicians who have used it empirically, but with good results, may not, at this belated day, feel exonerated from the crime that they were once thought to have committed in prescribing it; for cod-liver oil and similar substances have now a scientific basis for their use. Egg-yolk and butter-fat are two other foods that contain vitamins in comparatively large quantities, while lard contains practically none at all.

There are other factors besides vitamins, as they are thought of by Funk, that are concerned in nutrition. It has been pointed out again by Mendel and Osborn that certain amino-acids are very important factors. For instance, a protein must have in its structure the tryptophan radical, otherwise it will not support growth. Gelatin is a protein that is devoid of the tryptophan radical, and, to be of any use as a food it has to be taken with other vitamin or tryptophan-carrying substances.

A practical application of this subject that is of infinite importance is seen in the artificial feeding of infants. The accessory food substances it would seem, are easily destroyed by heat; and the feeding of infants over any long period of time on milk that has been subjected to high degrees of temperature has resulted in scorbutic diseases.

Another connection in which this knowledge will be of use is in the preparation of diets for prisons and similar institutions where practically all of the foods have been subjected to high temperatures, and, indeed, some of them to temperatures under pressure.

In conclusion, Saxon states that it is to be borne in mind that while a diet may be well balanced so far as its salts content and its content of fat, protein, and carbohydrate are concerned, it may still be an unbalanced ration, especially if it does not contain vitamin-carrying substances.

In an article on the "Relation of Diet to Beri-beri," Veeder¹ lays down the following rules: In any institution where bread is the staple article of diet it should be made from whole-wheat flour. When rice is used in any quantity the brown undermilled, or so-called hygienic, rice should be furnished. Beans, peas, or other legumes, known to prevent beri-beri, should be served at least once a week. Canned peas or beans should not be used. Some fresh vegetable or fruit should be issued at least once a week, and preferably at least twice a week. Barley, a known preventative of beri-beri, should be used in all soups. If cornmeal is the staple

¹ Journal of the American Medical Association, 1916, lxvii, 1494.

of diet it should be yellow meal or water-ground meal—that is, made from whole grain. White potatoes and meat, known preventatives of beri-beri and scurvy, should be served at least once a week, and preferably daily. The too exclusive use of canned goods is to be avoided. Veeder believes that adherence to these rules will prevent beri-beri and scurvy and also that they should prove equally efficacious in eradicating *pellagra* from the United States.

Romaimo¹ has found that the Italian soldiers now at the front not infrequently suffer from the lack of these accessory food substances. The Italian ration lacks vitamins, especially the antiscorvy vitamin. The effect of the restricted diet is to produce gastro-intestinal disturbances, constipation alternating with diarrhea, fetid breath, bluish gums, herpes and eczema. In many instances there are pains in the joint muscles and head. Epistaxis occasionally occurs. All the symptoms subside when fresh vegetables and fruit can be obtained. The distribution of lemons among the men has been found particularly advantageous. He states that the diet has been computed on the basis of muscular work, and contains too much protein, especially for men from the rural districts, who are not accustomed to much meat. Romaimo recalls the fact that with the introduction of the potato into Europe the great epidemics of scurvy ceased to appear.

The value of fruit juice in the treatment of atrophic infants under one or two years of age is emphasized by Glastone.² Any fruit juice available will do, provided the acid fruits are not used in too large a proportion. When oranges are out of season, lemon juice may be added to the sweeter fruit juices. A carefully selected diet is needed—one low in albumin and fat and high in sugar. Gladstone believes that the juice acts partly on account of its acid reaction, rendering the bowel unsuitable for germs growing in an alkaline medium. It has atonic cleansing effect on the mucous membrane of the digestive tract, and is a diuretic, diaphoretic, and general alterative.

It seems much more likely that the antiscorbutic vitamin contained in the fruit juice is the real reason for the improvement shown by these undernourished infants.

The *antiscorbutic* properties of milk have been studied by Gibson and Concepcion.³ Their experiments indicate that this property is present in milk in only slight amounts and that continued feeding of either fresh milk or autoclaved milk to animals, without suitable additions to the diet, induces certain beri-beri symptoms, *i. e.*, degeneration of the peripheral nerves, persistent edema, and aphonia. They found no evidence that autoclaving milk for two hours at 125° C. in any way affected its nutritive value. Not even scorbutic symptoms were observed. It would therefore seem advisable in bottle-fed children to extend the diet as soon as possible. Vitamin substances are probably present in human milk.

Another study on milk is that by Rettger.⁴ He concludes that pasteurizing or boiling milk for a short period does not destroy the nutritional

¹ Policlinico, May 6, 1917.

² Practitioner, November, 1916.

³ Philippine Journal of Science, Tropical Medicine, 1916, xi, 119.

⁴ Scientific Monthly, 1917, v, 64.

value, as numerous experiments have without doubt demonstrated, although physicians have from time to time claimed that heated milk as a diet for small children is conducive to scurvy. Where any doubt concerning this point has existed the feeding of small amounts of orange juice has been sufficient to allay fear.

PROTEIN HYPERSENSITIVENESS. Another interesting feature about foodstuffs is the idiosyncrasy some individuals occasionally manifest toward certain substances, particularly proteins. Longcope¹ has contributed an excellent article on the susceptibility of man to proteid material. It is well known that occasionally marked symptoms are produced in man by the injection of a foreign protein, usually in the form of a curative serum. This constitutes what is known as anaphylaxis. Occasionally, hypersusceptibility to a protein substance manifests itself after the eating of some article of diet. Thus it is noted that occasionally, in children, there is an idiosyncrasy to certain protein foods, especially eggs. Edleston² has reported a well-marked case of *egg anaphylaxis* in a child, first noticed at the age of twelve months. The first attack followed the taking of a few teaspoonfuls of custard pudding. The symptoms were those of acute gastritis with frequent vomiting. All food was withdrawn, and, later, chicken broth was substituted, under which treatment she recovered. Eggs in every form were avoided after this. Occasionally, when given accidentally, the symptoms have been as follows: The child complains of feeling ill and wants to lie down; the pupils dilate and vomiting follows. In some attacks, chemosis of the conjunctiva supervenes. Urticaria has occurred in some of the attacks. The child is now eleven years old, and is still as sensitive as ever to the poison.

I have already emphasized the necessity of the need of an educational campaign as to the *relative values of various foodstuffs*. Few people realize the high food value of some of the cheaper and commoner articles of diet. *Peanuts*, for instance, have a very high nutritional value—twelve double peanuts equalling 100 calories. Myers and Rose³ have pointed out that the *banana* has a higher caloric value than any other common fruit, and it has the additional advantage of being always in season. An ordinary sized banana equals 100 calories food value. The gastro-intestinal disturbances attributed to the eating of bananas is largely due to eating the fruit in an unripe state. When fully ripe, Myers and Rose noted no discomfort after their use for several days. When fully ripe, and when the starch has been converted almost completely to sugar, the authors' experiments show that its carbohydrates are well absorbed from the intestine. The composition of the banana and potato shows similarity, both in the total carbohydrate content and in the amount of different mineral constituents, and they have about the same caloric value. As they can be eaten uncooked, they are of importance in furnishing "accessory food substances," or the so-called vitamins, which are destroyed by heat. According to Myers and Rose the banana should be a valuable food in the dietetic treatment

¹ American Journal of the Medical Sciences, November, 1916.

² Practitioner, vol. xcvi, No. 4.

³ Journal of the American Medical Association, 1917, lxvii, 1022.

of *nephritis* in patients showing nitrogen retention. In mild cases of this disease they have obtained satisfactory results.

The *legumes*, such as *beans*, *peas*, and *lentils*, are extremely valuable foodstuffs not only because of their relative cheapness, in the dried state, but also because they are very rich in protein. Because of this fact, these foods, particularly the white bean, have been advocated by some as suitable substitutes for the animal protein food, which is very much more expensive. In addition to its high protein content the bean has the additional advantage of being rich in vitamins. In spite of its high protein content, however, the bean has certain disadvantages, namely, that the composition differs from the animal protein somewhat. This has been shown experimentally by McCollum, Simmonds, and Ritz.¹ They were able to show that when rats were fed on protein material derived solely from beans the mortality among the animals was high, and stunting of the growth was observed in all of them. They believed the injurious effects were due to mechanical injury of the digestive tract, due to the distention caused by fermentation, thus rendering the growth of putrefactive microorganisms easier; interference with the circulation of the gut because of excessive distention; and, lastly, the quality of the protein contained in the white bean. Their conclusion is that, at present, available data indicate that bean protein is decidedly inferior to those of milk, meat, eggs, and those of cereals so far studied, *viz.*, wheat, maize, oats, and rice.

High prices and the scarcity of many of the commoner foodstuffs have turned the attention of many to cheaper and more available substitutes.

These suggestions are not always of the best, and occasionally are absolutely dangerous, as can be seen from the following. It has been advised, for instance, to substitute rhubarb leaves for "greens." The leaves and leaf stalks of rhubarb contain citric, malic, and oxalic acids, and, of these, the latter is distinctly poisonous if taken in sufficiently large quantities. A case of death has been reported² from the use of rhubarb leaves in Enfield, England. A warning has been issued by the Health Officer against the use of the leaves as a substitute for greens. A similar step has been taken by the United States Department of Agriculture.³

The use of raw eggs is so universally practised in those under weight and in those with poor digestion that it is interesting to note that Bateman⁴ has shown, from his experiments, that raw egg-white is a decidedly indigestible substance. It may cause diarrhea and vomiting when ingested in large quantity. Its utilization by the body is poor, since it is used only to the extent of from 50 to 70 per cent.

CARBOHYDRATE INTOLERANCE. The danger of adhering too closely to one article of diet is emphasized by Bloch.⁵ The cases described by him are, in all probability, examples of nutritional disturbances arising

¹ Journal Biological Chemistry, 1917, xxix, 521.

² Pharmaceutical Journal, May 12, 1917.

³ Weekly News Letter, U. S. Dept. Agriculture, May 23, 1917.

⁴ American Journal of the Medical Sciences, June, 1917.

⁵ Ugeskrift for Læger, February 22, 1917; Journal of the American Medical Association, May 12, 1917.

from an absence of vitamins. He has reported what he terms "carbohydrate children." These children have been fed on a diet consisting almost entirely of carbohydrates, several types of nutritional disturbance. Small, weak children emaciate, have diarrhea, the tissues atrophy, and the viscera show degenerative changes. Older and stronger children are apt to develop a dropsical or hydremic condition of the tissues without, however, the presence of albumin in the urine. Skin eruptions, opisthotonos, and other contractures may develop. In the type with dropsy the children may present a "plump" appearance, which leads the mother to believe they are thriving satisfactorily. They are particularly liable to acute infections. In treating these cases, Block states that albumin and fat must be given, but care must be exercised not to give too much fat at first, particularly of cow's milk, or chronic dyspepsia may result. The carbohydrates must not be suppressed entirely. Breast milk is indispensable in the severe cases, and is best for all.

The too exclusive use of a carbohydrate diet often produces a diarrhea with a marked acid reaction in the stools. It is a mistake to treat this form of diarrhea with astringents. Albumin milk to which is added 2 or 3 per cent. grape-sugar will bring about the desired improvement. Severe diarrhea with general symptoms calls for a day or two of water alone, and then milk and water until all signs of intoxication are past. Not until then should carbohydrates be given.

FAT INTOLERANCE. Another very common error in the prescribing of a diet is the excessive use of fat. I have called attention to this in previous numbers of *PROGRESSIVE MEDICINE*. So far as I recall, Edsall first directed attention to fat intolerance some years ago. The evils arising from the overuse of fat in the dietary are often seen in tuberculous patients who are undergoing "forced feeding." Very frequently they are given large quantities of fat. Individuals vary tremendously in their ability to assimilate fat, and they furthermore vary in their capacity to handle fats of different kinds. Eggs, the yolk of which is very rich in fat, seems particularly difficult to digest by some individuals. As seen in adults the manifestations of fat intolerance are as follows: The patient loses his appetite, is constipated, the tongue is coated, the breath foul, and varying degrees of headache occur. The patient feels nauseated and may vomit. In other words, the picture is that of the so-called "bilious" attack. Tuberculous patients who previously have been afebrile also usually show some elevation of the temperature. The stools are, in extreme cases, grayish in color and greasy in appearance, and in all cases undigested fat globules can be shown microscopically. The almost inevitable result is that the gain in weight which has been obtained by this hyperfat alimentation is quickly lost as the result of the measures needed to straighten out the gastro-intestinal tract. Fats must be abandoned and the diet, as a whole, reduced to a minimum. As a rule a few days suffices to relieve the patient of his symptoms and restore the desire for food. In most instances if the fat-content of the diet is kept low the patient begins gaining weight again, although it may be necessary to use skimmed milk

instead of whole milk for some time. The main point is to determine the amount of fat that can be safely taken.

A condition very similar to that occurring in adults is described by Lowenburg,¹ and seen in infants. In bottle-fed children a common error is to overprescribe the amount of fat in the diet. The result is that the child becomes constipated, with pasty, greasy-looking stools; it presents a flabby appearance, is fretful and irritable, fails to gain in weight, and often shows evidences of incipient rickets. Lowenburg states that, unfortunately, the necessary dietary adjustment is rarely made, but, instead, the physician falls into the error of attempting to relieve the most annoying symptom, namely, the constipation, by means of drugs. And to increase the difficulty, the attempt is made to overcome the stationary weight by adding more fat to the diet in the form of cream or top milk. Just as in adults the essential features of the treatment are, first, to correct the existing gastro-intestinal condition by the temporary abandonment of fats and the use of a restricted diet, and, secondly, to determine later the amount of fat the child can safely digest and absorb. As Lowenburg states, tolerance is a broad term, and the fat needed will vary greatly in the individual case; but this can practically always be determined if the dietetic treatment is individualized. Adherence to a fixed prescription diet is to be avoided.

DIETETIC TREATMENT OF DISEASE. *Diabetes Mellitus.* One of the most brilliant triumphs of recent years is the dietetic management of diabetes. The Allen, or starvation, method of treating diabetes has been reviewed in a previous number of *PROGRESSIVE MEDICINE*. Although Allen's method has been criticised by some and modified by others, I believe that the great majority of observers have accepted his plan with little or no change. During the past two years I have been especially interested because I have employed the Allen treatment in 9 cases of diabetes in which an active or latent pulmonary tuberculosis also existed. This combination is usually a vicious one, and all my previous experiences had been disastrous. As I see the problem now, this was due to the fact that I attempted to treat the tuberculosis as the principal difficulty, and attempted, in a half-hearted manner, to control the diabetes. Attacking the diabetes and disregarding the tuberculosis is, in my opinion, the proper procedure. While it may seem strange to advise, for a tuberculous patient, several days of starvation and a considerable period during which the diet is much restricted, my experience has shown that the tuberculosis process is not accelerated. On the contrary, the control of the diabetes leads to improvement in the symptoms due to the tuberculous process, in spite of the loss in weight which is unavoidable. If the tuberculosis is of the actively progressing type, irrespective of the presence of diabetes, a fatal issue is to be expected; but this does not seem to be hastened by the submitting of the patient to the so-called starvation treatment. I expect shortly to report these cases in detail.

¹ *Therapeutic Gazette*, July, 1917.

The essential feature of the Allen treatment of diabetes is to determine the diet which is within the limit of tolerance. This was first thoroughly studied experimentally and then applied successfully in man. Allen assumed that interference with the internal functions of the pancreas is the essential feature in all cases of diabetes, and that the condition is comparable to that existing in animals after partial resection of the gland, there being a loss of some of the glandular substance and a functional disturbance of the remainder in both. While it is true that structural deficiencies cannot be made good, both experimental and clinical experience has shown that the power to metabolize more or less carbohydrate is restored, if a sufficiently long period of physiological rest is given. As the necessary physiological rest can only be obtained by abstinence from food, fasting must be enforced until the total disappearance of the glucosuria. When examination of the urine shows that it has been free from sugar for twenty-four hours, feeding is commenced. Small quantities of food are given, the object being to so arrange the diet as to test the patient's tolerance for the three chief food materials—carbohydrates, proteins, and fats.

Cambridge¹ emphasizes the necessity of thoroughly understanding the principles of Allen's method if full advantage is to be taken of his work. Education of the patient is always an important feature. This is essential to success. The patient must have explained to him the nature of his trouble; the reasons for giving the diet necessary to control the disease; and the signs to be looked for if the point of tolerance is passed. Last spring I had the privilege of seeing a large group of diabetics under the care of Joslin, of Boston, treated by the group or class method. They met once a week and had discussed before them the general principles of the management of diabetes, and any special features that may have presented themselves in individual patients. The plan and method of conducting these diabetic classes are identical with those first advocated by Pratt in the treatment of tuberculosis. In a second article, Cambridge² again touches on certain features of the Allen treatment. He considers that it makes a great advance in the treatment of the disease and gives results in many instances, obtainable by no other means. He emphasizes the point that the keynote of the treatment is undernutrition. He directs attention to a practical point that sometimes arises, namely, whether a controlled, and maybe mild, glucosuria with an adequate diet and reasonable enjoyment of life is not preferable to the theoretical ideal of permanently sugar-free urine, which can only be secured by a diet that often does not satisfy the pangs of hunger and requires constant supervision. Cambridge believes that this will depend a good deal on circumstances and the temperament of the patient.

Nicholson³ states that he has given up all proprietary flours and *breads* and now uses a bread made of *peanut flour* and *casein*. It has an agreeable taste and can be cut in thin slices. The bread is made

¹ Practitioner, November, 1916.

² British Medical Journal, April 14, 1917.

³ Ibid., January 20, 1917.

as follows: The white of an egg is beaten to a snow and then the other ingredients (previously lightly mixed) are slowly added. The formula is as follows:

Peanut flour, eight ounces.

Casein, two ounces.

A pinch of salt.

White of egg, twelve ounces.

It takes the whites of 8 or 9 eggs to make the twelve ounces.

Heart Disease. Lovand¹ is authority for the statement that, in his experience, individuals who live on a predominantly vegetable diet do not get fatigued so readily as on an abundant meat diet. He believes there is something in vegetables and fruits that enhances muscular activity. This may be due to potassium, which is contained in vegetables. Thus it has been shown experimentally that rats deprived of potassium developed paralysis, hemorrhages and a fatal cachexia. If potassium is added to the diet, they recuperated and grew strong again. Lovand's conclusion is that organic compounds of potassium are indispensable to keep nerve and muscle substance in normal condition. Everything that promotes muscular functioning help to keep the heart muscle in good condition as well as the other muscles. With a weak heart, particular care must be paid to these intangible elements in the diet.

Nephritis. Machwitz and Rosenberg,² in a study of the treatment of nephritis, state that daily analyses of the urine and repeated tests of kidney functioning over long periods, in a long series of cases, have confirmed that it is immaterial, so far as the kidneys are concerned, whether animal or vegetable albumin is given, meat instead of milk, and black bread or white bread. Sometimes fruit juices are useful to supply needed calories in part of the fluid. In a list of "don'ts" to be observed in the management of cardiovascular disease, Stoll³ says: "Don't tell the patient with moderate hypertension, few symptoms, and whose kidneys are functioning well, to stop eating meat and go on a milk diet."

Pellagra. The relationship between diet and pellagra is still unsettled. In speaking of the vitamins, I stated that the disease might quite possibly be due to a lack of the accessory food entrances. At the present time the evidence in favor of this view is not strong, as can be seen from the following contradictory reports:

Siler, Garrison and MacNeal⁴ have made an intensive study of a small mill community in South Carolina. The dietary of the inhabitants was made the subject of special study. This was done by a house-to-house canvass, by interviews with the mill authorities and the keepers of stores and meat markets. They could not discover any marked changes in dietary habits during the past ten years which would serve to explain the absence of pellagra from the village from 1900 to 1905 and its high rate of prevalence from 1911 to 1914. Furthermore, a

¹ Münchner med. Wchnschr., December 19, 1916.

² Ibid.

³ Journal of the American Medical Association, September 16, 1916.

⁴ Archives of Internal Medicine, August, 1917.

careful inquiry during this house-to-house canvass in 1915 and 1916 failed to reveal any general change in the dietary habits of this population from those of previous years. They conclude that their studies support the hypothesis that pellagra is an infectious disease, which spreads slowly, attacking only a small proportion of the population residing in the immediate vicinity, and they indicate, further, that its spread is especially favored by insanitary methods for the disposal of human wastes.

During the past two years surveys have been made in the city of Nashville by Jobling, Petersen, Tucker and Costen.¹ In regard to diet, they encountered two factors which are contradictory. On the one hand, they found a definite number of cases which developed in individuals partaking of a diet as varied and as wholesome as could be desired, even by those who uphold the dietary theory, and, in addition, pellagra was encountered in breast-fed infants of non-pellagrous mothers. On the other hand, at least half of the cases develop in individuals living on a ration low in protein, high in carbohydrates, and monotonous in character. It is also to be noted that the pellagrous condition is favorably influenced by a change in diet.

In the treatment of *pellagra*, Raines² recommends a liberal diet. He prohibits fat meat, corn bread, and much sweets. The moderate use of sweets he does not object to, providing they do not disturb the stomach or bowels. If good meal is procurable he sees no reason why the well should not eat it as a prophylactic. By good meal he means sound corn, the ears "nubbed" at both ends and ground in a slow mill.

Exophthalmic Goitre. Ochsner³ lays down the following rules for the postoperative treatment of exophthalmic goitre: An abundance of rest. Avoid all excitement or irritation. Plenty of fresh air, both day and night. Eat and drink nothing that irritates the nervous system, such as tea, coffee, or alcohol. Do not use tobacco. Eat very little meat. If fond of meat, take a little beef, mutton or breast of chicken, or fresh fish one to three times a week. Drink a great deal of milk and eat food prepared with milk, such as milk toast, milk, soups, etc. Cream and buttermilk are especially good. Avoid any kind of meat broths. Eat an abundance of fresh fruit and cooked vegetables or very ripe raw fruits, or drink fruit juices prepared from ripe fruit. Eat plenty of eggs, bread, butter, toast, rice, and cereals. Drink plenty of water.

Typhoid Fever. For several years past Coleman⁴ has advocated a liberal diet in the treatment of typhoid fever. The details of his method have been given in previous numbers of *PROGRESSIVE MEDICINE*. He has recently published another paper on the subject. The results are summarized as follows: A comparative study of 222 cases of typhoid fever on the high calory diet and of an equal number of cases on a milk diet has brought out the fact that the natural history of the disease, as it has previously been known, is profoundly altered by the maintenance

¹ Journal of Infectious Diseases, August, 1917.

² Memphis Medical Monthly, February 1, 1917.

³ Annals of Surgery, 1916, lxvi, 385.

⁴ Journal of the American Medical Association, August 4, 1917.

of an optional state of nutrition. The range of temperature apparently is not affected, but the total duration of the disease is shortened, in some instances by months, through the shortening of convalescence. Certain symptoms which hitherto have been attributed to the specific action of the typhoid bacillus have been discovered to be due to faulty methods of treatment, in particular, to an inadequate or improperly balanced diet. Complications are rendered less formidable, and perhaps less frequent, by maintaining the patient in the best possible state of nutrition. Moreover, the mortality from the disease is reduced by from 50 to 75 per cent.

Digitalis. Digitalis is among the drugs which the present war has made difficult to obtain. In the case of digitalis this is due to the fact that we have depended almost entirely on the German leaves. In order to overcome this difficulty the late M. I. Wilbert suggested the examination of wild-growing digitalis, which is abundant in certain sections of this country. This was accordingly done by the division of pharmacology of the Hygienic Laboratory of the United States Public Health Service.¹ Samples of wild plants from the Northwestern States and cultivated plants from Wisconsin and Ohio were collected, and tinctures made according to the United States P. H. method. The conclusion reached from this investigation was that the wild digitalis found in the Northwestern States may be used as a source of supply from the various official preparations of digitalis, and that by using the ordinary methods of handling and preparing the leaves a highly active product may be secured which compares favorably with the activity of the cultivated leaves grown under more favorable conditions. J. H. Pratt, of Boston, has also demonstrated the potency of the American leaves.

Many years ago, in a clinical lecture, I once heard that distinguished clinician, J. M. DaCosta, state that more and more he had come to depend on digitalis in the treatment of *croupous pneumonia*. He adhered to this opinion in spite of the dictum that digitalis was inactive in the presence of fever. It is therefore interesting to note that Cohn and Jamieson² have recently proved that digitalis is of distinct benefit in the treatment of pneumonia, and that it possibly is a life-saving agent in cases of auricular irregularity (fibrillation and flutter). They employed digitalis in the form of *digipuratum* in 49 cases of pneumonia, using 56 other cases, which received no digitalis, as controls. The drug was given by mouth in the form of tablets, the dose usually being 1½ grains four times a day. The action of the drug was studied by the electrocardiograph. This showed that digitalis given by mouth has an action on the heart, because changes occurred in the auriculo-ventricular conduction time and in form of the T-wave of the electrocardiogram, just as they do in the non-febrile heart. This would seem to indicate that the fever present in pneumonia does not interfere with the action of the drug, and that the intoxication due to the disease does not interfere with its effects. This conclusion is strengthened by finding that the pulse-rate in fibrillating and fluttering cases fell in the

¹ Public Health Reports, March 9, 1917.

² Journal of Experimental Medicine, January, 1917.

presence of fever exactly as it does in non-febrile cases. The dose and the time required to produce these effects are given, and are the same as in the non-febrile cases. In an article on the treatment of pneumonia by remedies other than specific methods, Fussell¹ recommends digitalis as a circulatory stimulant, especially in the presence of dilatation of the right heart. Digitalis or strophanthin must be used hypodermically to strengthen the heart muscle in cases with a sudden fall in blood-pressure, weak, running pulse, and leaking skin.

Greene² has emphasized the fact that the most essential thing in the management of *cardiovascular disease* is to keep constantly in mind that the most vital matter is the condition of the heart muscle. However important the detection and specific differentiation of valvular lesions may be, it is the condition of the heart muscle which determines the seriousness of the disease. Practitioners are too prone to estimate the condition of the heart on the basis of a murmur or no murmur. As a result, the most serious cardiac lesions are allowed to pass unnoticed, the first intimation of serious trouble being an attack of heart failure or even sudden death.

In regard to the use of digitalis, Greene gives the following advice:

"Use a standardized preparation of maximum reliability and potency and drive the primary effect home by full doses carried only to the point of producing a definite physiological effect; then withdraw the drug for a few days and repeat the process as often as may be necessary and over as long a period. Unless impelled by absolute necessity, do not place the remedy in the hands of a patient at a period when the results of adequate administration demand careful medical interpretation, for it is certain to be either over- or underused, with resulting disappointment to all concerned. The effect of very small, long-continued doses administered after the primary purpose is achieved is sometimes surprising, but these also should receive some measure of supervision."

It seems hardly necessary to repeat the well-known maxim that digitalis should never be used unless there are signs of heart failure. Willmore³ states that to give digitalis to any patient who comes to us with an aortic or mitral murmur, and who does not show signs of heart failure, is to commit a therapeutic crime. "Why is it that in one case we give digitalis with immediate and great benefit, while in another, apparently similar, there is no appreciable result?" A common reply is that the drug was old and had lost its strength. This Willmore does not believe, as in his opinion digitalis is a very stable drug. The real reason in his estimation is that digitalis is of marvelous value in cases of *auricular fibrillation*, and is of practically no value in any other condition. The value of the drug under these circumstances is that it acts especially on the auriculoventricular bundle—it depresses conduction. In auricular fibrillation there are all sorts of "hurried, haphazard impulses passing down to the ventricle, which, in responding to them, is harassed almost out of existence." Depression of this conduction

¹ Pennsylvania Medical Journal, February, 1917.

² Journal-Lancet, October 15, 1916. ³ Indian Medical Gazette, November, 1916.

both makes it more difficult for these impulses to pass, and, as a result, the ventricle beats more steadily and slower. Thus the circulation is carried on more efficiently and heart failure is averted or removed. Cushman¹ also believes that one of the chief actions of digitalis in auricular fibrillation is its effective blocking of impulses from the auricle.

Willmore emphasizes two fundamental facts in connection with heart disease. In any case of cardiac disease the essential thing is not the valvular lesion but the condition of the heart muscle. If the cardiac muscle has escaped degenerative changes the valvular lesion is usually immaterial, as the reserve power of the heart is almost incalculable. On the other hand, the slightest degree of muscular damage, especially if the auriculoventricular bundle is involved, may lead to the most serious symptoms. Willmore believes that the most important symptom of heart disease is breathlessness, and that the degree of breathlessness may be taken as an index of the amount of heart failure; increasing breathlessness means increasing heart failure, and *vice versa*. It is chiefly important as an early symptom. If any individual becomes breathless in performing acts he was formerly able to do with impunity it is certain that the reserve power of his heart is diminished. One should always exclude the presence of a pleural effusion in cases of breathlessness of obscure origin.

In regard to treatment, Willmore advises the smallest amount of digitalis which will steady the ventricle and which does not produce symptoms. It may take some weeks or months to find the optimum dose in any special case. Having been found, the patient should ordinarily take it for the rest of his life.

The advance in our knowledge of cardiac conditions from the use of instruments of precision is pointed out by Boruttau and Stadelmann.² Thus by the use of the *electrocardiograph* it has been shown that *constant arrhythmia* often occurs with a comparatively sufficient heart. This has been hitherto entirely overlooked when the intervals between the pulse beats do not show extreme and sudden differences. Very small doses of digitalis restore conditions to approximately normal in these cases, slowing the heart beat and strengthening the pulse. They quote observations made by Fahrencamp on 412 cases of heart disease. He also advocates the use of digitalis in small doses and kept up for a long time in cases of *perpetual arrhythmia (auricular fibrillation)*. The digitalis can be given continuously under control of electrocardiography. It should be supplemented and alternated with diuretics and the mode of life and diet regulated to correspond. The experience of Boruttau and Stadelmann demonstrate the retarding action of small doses of digitalis on the overfrequent beat of the auricles bordering on fibrillation.

In the management of *arterial hypertension*, Stoll³ states that digitalis is nearly always required irrespective of the blood-pressure; fears of producing a higher tension are groundless. Not infrequently a combina-

¹ Lancet, June 9, 1917.

² Deutsche Med. Wehnschr., January 4, 1917.

³ Medical Record, October 28, 1916.

tion of potassium iodide and digitalis will give results not obtainable when either is used alone.

Electricity. In spite of the great benefits to be derived from the use of electricity, it is undeniable that many physicians know very little about the proper application of this agent or the conditions in which it is of service. As a matter of fact it is often used in conditions in which it is distinctly contra-indicated, as, for instance, in paralysis due to acute inflammation. Furthermore, the fact that charlatans have so frequently, in the past, advertised electricity as a cure-all has prejudiced many against it. Although electricity is being used more and more there is still much to be desired. W. L. Clark¹ states that progress in this field has been retarded by the following conditions:

1. The ancient teaching that electricity is purely psychic in action, and that its chief use, therefore, is in the field of neurology, with persistent adherence to this doctrine despite demonstrable evidence of many physiological effects and its applications to other fields.

2. The erroneous statements appearing in modern text-books on electrotherapy, also in special chapters contributed to standard works on general therapeutics, statements which evidently have been copied from old works containing ideas long since discarded by physicians who have kept pace with progress.

3. The absence of even rudimentary teaching in the majority of undergraduate and postgraduate medical schools.

4. The prejudice which has arisen from the association of electrotherapeutics with irregular practice, and the unwarranted claims and pseudoscientific teaching of honest, but erring, enthusiasts who do not use critical methods of control in their work.

5. A lack of proper standardization of electrotherapeutic apparatus. This condition is due to the fact that manufacturers do not know what is best suited to the needs of the profession, and that physicians, because of the lack of technical knowledge, cannot advise them. The consequence is that each manufacturer sets his own standard, with an ensuing confusion in the reports of results by different physicians possessing different apparatus. This is especially true when apparatus for the generation of high-frequency currents is concerned, since these currents are subject to great variation both as regards their character and the effects produced by them on the organism.

Potts² cautions against the use of electricity in paralysis when the cause is an acute inflammation. To use unduly strong currents, thus producing an excess of contractions, is especially dangerous in the presence of disease of the peripheral motor neuron, since in such cases there is more atrophy of the muscle fibers and overstimulation will cause exhaustion and destruction of the remaining vitality. The current used should be merely strong enough to cause contraction, and only a few should be produced at each sitting. If contraction can be obtained only by very strong currents, postponement, if such treatment

¹ Pennsylvania Medical Journal, March, 1917.

² Therapeutic Gazette, May, 1917.

may be advisable, until some measure of power has been obtained by other methods. Especially is this true in anterior poliomyelitis where overtreatment may cause harm. Potts quotes the dictum of H. C. Wood, Sr., to "use the current which gives the best contraction with the least pain."

Emetine. A large number of communications have appeared on emetine during the past year. A brief historical sketch of the drug is given in an editorial article in the *Journal of the American Medical Association* (Feb. 3, 1917). *Ipecac*, from which emetine is derived, is the root of a Brazilian herb. It was said to have been in common use in Brazil before being brought to Europe by Piso about 1650. It is said that shortly afterward a charlatan by the name of Adrian Helvetius placarded Paris with the announcement that he had a cure for dysentery. Hearing this, Louis XIV summoned him to treat the Dauphin who was suffering from the disease. The patient recovered and the formula of the cure, of which ipecac was one of the ingredients, was purchased by the French government and made public. Helvetius is said to have obtained it from a physician in the Netherlands. From that time the drug has been used empirically for dysentery irrespective of its etiology.

"Two centuries later, Docker introduced the use of large doses (60 grains two or three times a day) of powdered ipecacuanha in the treatment of severe dysentery in Mauritius. In 1886 Maclean and Chevers advocated the use of ipecac in acute hepatitis. Later the drug fell into more or less disrepute, but its use has been revived as a result of Manson's advocacy of its employment in dysentery and Rogers in hepatitis."¹

In 1817 Pelletier isolated from ipecac the so-called active principle emetine. In 1910 Vedder, in Manila, demonstrated that emetine, even in highly diluted solutions, kills *Ameba histolytica*, the cause of dysentery. Shortly afterward Roger, in India, used the emetine clinically with great success. Since his first communication the drug has become universally recognized as a specific for *amebic dysentery*. As so frequently happens a therapeutic agent that has proved its efficacy in one condition is often used empirically in a variety of diseases. Emetine is no exception to this rule.

The widespread use of emetine has brought to light the fact that the drug, if injudiciously used, is capable of producing serious *toxic effects*. In a study of the pharmacology of emetine, Pellini and Wallace² emphasize the following points: It depresses and may eventually paralyze the heart. It is a powerful gastro-intestinal irritant, whether given by mouth or subcutaneous injection. It also causes a definite derangement of metabolism, characterized by an increase in nitrogen loss and acidosis. In normal individuals and moderate doses, toxic effects are not of great importance, but in pathological states of the circulation, or metabolism, there may be a very definite source of danger.

¹ Crowell, *Journal of the American Medical Association*, July 7, 1917.

² *American Journal of the Medical Sciences*, September, 1916.

Dalimier¹ has studied the toxic effects of emetine hydrochloride in rabbits and guinea-pigs. Applying to man the figures obtained in animals, Dalimier estimates that the dose which would induce symptoms of a toxic action in man weighing 60 kg. (135 pounds) as 0.12 gm. (1.8 grains) by intravenous injection and 1.8 grams (27 grains) by subcutaneous injection. The maximal safe dose would be 0.06 gm. (0.9 grain) by intravenous injection and 1.2 grams (18 grains) by subcutaneous injection. Dalimier believes that emetine has a cumulative action. In his opinion the total dose should not exceed 1 gram (15 grains). He is convinced that in certain cases of dysentery in which emetine has been used, some of the symptoms that have been attributed to the disease were, in fact, the work of the emetine. In reporting on the treatment of 142 cases of entamebic dysentery with emetine, Johnson and Murphy² found that its use, results, and dangers were somewhat analogous to those of salvarsan in syphilis. In their series there were 2 cases in which death resulted from the toxic effects of emetine, and 5 others had symptoms which they believe were caused by emetine. In the fatal cases the symptoms were as follows: Inability to swallow after food had reached the esophagus; marked congestion of the lungs; rapid and uncontrolled action of the heart. In both patients there was, at first, general motor weakness affecting particularly the muscles of the back of the neck, with a tendency of the head to fall forward, later a difficulty in swallowing, and, finally, a pneumonia of the lobar type. These 2 cases received a total of $23\frac{1}{2}$ and 25 grains respectively. Dalimier³ quotes the case of a man, aged twenty-eight years, who received a total dose of between 21 and 22 grains of emetine in the course of eighteen days. When this total was reached there was first a flaccid paralysis of all the muscles, most pronounced in the neck, so that he could not hold up his head. Then followed disturbances in swallowing, chewing, and speech, edema of the face, diminution of the reflexes, and a rapid and weak heart action.

The doses administered in these cases are far in excess of what Dalimier considered to be safe. In the 5 non-fatal cases observed by Johnson and Murphy the symptoms quickly disappeared when the emetine was withdrawn.

Another of the untoward effects of emetine is the production of a *peripheral neuritis*. Kilgore⁴ draws the following conclusions:

1. Peripheral neuritis after emetine is not uncommon.
2. The symptoms most commonly met with in postemetine neuritis are generally muscular pain and weakness, usually most pronounced in the legs, sometimes going on to paresis. One case is here reported of hyperesthesia of the soles of the feet without other symptoms.
3. The neurotic symptoms often develop after the emetine injections have been stopped, and may grow progressively worse for some time, with no more administration of the drug.

¹ Presse Médicale, January 18, 1917.

² Military Surgeon, January, 1917.

⁴ Boston Medical and Surgical Journal, September 14, 1916.

³ Loc. cit.

4. The total amount of emetine necessary to produce neuritis varies greatly. The total amounts received by the cases recorded by Levy and Rowntree and those reported here are as follows:

	Grains.	Grams.	
Adult	19.5	(1.25)	Severe neuritis
"	6.0	(.39)	Severe neuritis
"	21.3	(1.40)	Mild neuritis
"	12.8	(.85)	Moderate neuritis
" about	10.0	(.65)	Mild neuritis
"	15.0	(.95)	Moderate neuritis
Age 8	6.0	(.39)	Mild neuritis
" 7	5.5	(.36)	" "
" 5	4.0	(.26)	" "
" 4	4.0	(.26)	" "

On the other hand, many patients receive larger amounts and have no symptoms. On going over the records at the Shanghai Hospital for eighteen months it was found that one white patient had received 13 grains (0.85 gram), three Chinese had 11 to 12 grains, and one 21 grains (1.35 grams), with no symptoms of neuritis recorded.

5. The prognosis is good. The symptoms clear up gradually, usually over several weeks, leaving no traces apparent.

6. Experiments (now in progress) suggest that peripheral neuritis may be produced by emetine in healthy dogs.

Kilgore and Liu¹ point out that emetine sometimes produces a bloody diarrhea. It is well known that in large doses emetine hydrochloride gives rise to a hemorrhagic gastro-enteritis in experimental animals. That the same thing may occur following its clinical use is not so well recognized. They state that the difficulty in the recognition of diarrhea from emetine, as well as its danger, is due to the fact that it occurs in the course of treatment for amebic dysentery, and that the symptoms and the gross appearance of the stools in emetine diarrhea are almost indistinguishable from those in amebic dysentery. The patient receives daily doses of emetine and for a few days improves, and the amebas disappear from the stools, which becomes more or less normal. Then the diarrhea becomes worse, with reappearance of blood and mucus in the stools. Mistaking this condition for a relapse of the dysentery, the emetine is pushed, which only increases the diarrhea, and, if the condition is not recognized, serious results may easily follow.

Kilgore and Liu report 3 cases in which the diagnosis of emetine diarrhea, produced in the course of treatment for amebic dysentery, is reasonably certain. Recovery was prompt on discontinuing the emetine. All the cases were children, and all had received doses considerably larger than would be proportionate on a basis of 65 mg. (1 grain) for an adult. They point out that this fact is interesting in view of the opinion not infrequently held that children are more resistant to emetine than adults. They now give doses of 1 grain (subcutaneously or intravenously) to adults and proportionately smaller doses for children, watching carefully for any increase in the diarrhea which might be due to emetine.

¹ Archives of Internal Medicine, August, 1917.

In an experimental study, Guglielmetti¹ found that no matter how the drug is administered it reaches the digestive tract, being found exclusively in the stomach, intestines, and liver and their contents.

Hare,² in commenting editorially on the toxic effects of emetine emphasizes the need of employing the drug with care, especially in individuals who have been weakened by disease. It must be borne in mind that emetine, in common with other drugs capable of doing good, is equally capable of doing harm if wrongly used.

Although emetine is now ranked as one of the few specific drugs we possess, it has, in common with the others, its limitations. Its efficacy in *amebic dysentery* is in direct proportion to the acuteness of the attack. If the disease has gained a foothold, and the protozoa have burrowed into the intestinal wall and are furthermore associated with secondary infection, emetine may fail to eradicate the disease. The drug is also powerless against encysted ameba and in ameba carriers.

With a view of avoiding toxic effects, Johnson and Murphy³ recommend the following method in the treatment of *amebic dysentery*: $\frac{1}{3}$ grain daily hypodermically, increasing by $\frac{1}{3}$ each day until 1 grain is given per diem, and this is continued until a total of 8 grains has been administered altogether. With the emetine, bismuth subnitrate in large doses is given. For a period of ten days following the course in emetine, colonic irrigations of 1 to 1000 quinine solution are given once or twice daily. If the stools still show the presence of amebae, 1 grain of emetine is given daily for three days. By this method of treatment the patient received 11 grains, which is less than the single lethal dose as given by Sir Leonard Rogers, and is well below the total dosage advised by Dalimier. Occasionally, a third course is necessary, but this should not be started until a sufficient lapse of time and not then if asthenia, motor weakness, irregular heart action, nervous exhaustion or irritative diarrhea is present. In the protracted cases, it is especially necessary to exercise caution in the administration of the drug.

Although emetine has demonstrated its value in acute *amebic dysentery* it usually fails to achieve a cure in the chronic forms of the disease and in "carriers." Several years ago Du Mez, of the school of pharmacy of the University of Philippines, suggested the use of a double salt of emetine and bismuth (*emetine-bismuth iodide*) in the chronic types of *amebic dysentery*.

The following is the formula of emetine-bismuth iodide:

Iodine	58.26	per cent.
Bismuth	12.36	"
Hydrogen (as hydrogen iodide)	0.30	"
Emetine	29.08	"

Emetine-bismuth iodide is a brick-red powder, insoluble in water or water acidulated with hydrochloric acid, and stable in air. According to Du Mez's calculations it contains 58 per cent. iodine and 12 per cent. bismuth, with 29 per cent. emetine. Insoluble salts of bismuth are

¹ Prensa Medica Argentina, June 20, 1917.

² Therapeutic Gazette, June, 1917.

³ Loc. cit.

converted into bismuth sulphide after passing the pylorus, and in all probability the reaction is very slow, taking place as the compound is spread out over the wall of the intestines. Three grains of this double salt, containing about 1 grain of emetine, is about the average daily dose, and twelve such doses may be given in succession. Dobell,¹ who has given this double salt a trial, administered it in cachets containing 1 grain each until 36 grains had been taken. It is recommended that the drug be given after a full meal, when the stomach contents will be certainly acid. As a rule the drug was well tolerated, and vomiting, if it occurred, did not come on until some time after the dose had been taken, indicating, probably, absorption from the intestine and not from the stomach. It was hoped that this double salt would prevent vomiting, which was so annoying a complication of the old ipecacuanha treatment. This, however, has not been entirely the case. In a few cases it was a troublesome symptom. Its disagreeable features may have been exaggerated by some observers, as a number of reports are enthusiastic over the results. Dale's² results with the double salt have been very promising.

Imrie and Roche³ report 6 cases treated by emetine-bismuth iodide which had been unsuccessfully treated with emetine hydrochloride. Forty-eight hours after the use of the bismuth compound the endamebæ disappeared, and in no case did they reappear under observation for periods varying from 14 to 32 days.

A study of a series of cases of *amebiasis* with liver involvement has convinced Low⁴ that emetine-bismuth iodide is of great value. He emphasizes the well-known shortcomings of emetine when administered hypodermically in the chronic forms of the disease, namely, that the encysted ameba are more or less completely shut off from the circulation and tissue fluids of the patient. According to Dale,⁵ the alleged superior efficiency, in this type of case, by the older treatment with ipecacuanha by mouth, was due to its absorption from the intestines.

Low administered the emetine-bismuth iodide in 3-grain doses every night for twelve consecutive nights (36 grains in all). In his opinion not less than 36 grains should be given, otherwise a relapse will usually occur.

In the treatment of *liver abscess*, Ghosh⁶ advises evacuation of the abscess, followed by intrahepatic injections of emetine. In this way the drug is brought into direct contact with the amebæ. Besides, a much stronger solution can be used than when the drug is used hypodermically, without causing toxic symptoms. Ghosh cites 2 cases in which as much as 1½ grains of emetine was injected into the abscess cavity.

An excellent review of the treatment of amebiasis by emetine is given by Crowell.⁷

In the subacute or chronic stage of *follicular enteritis* in infants,

¹ British Medical Journal, November 4, 1916.

² Lancet, July 29, 1916.

³ Ibid., 1917, xcii, 17.

⁴ Ibid., March 24, 1917.

⁵ Loc. cit.

⁶ Calcutta Medical Journal, January, 1917.

⁷ Journal of the American Medical Association, July 7, 1917.

Azcoitia¹ found emetine effectual when other measures had failed. No explanation is offered as to why the drug is effective in this disease.

Several years ago emetine attracted a great deal of attention as a cure for *pyorrhea alveolaris*. In this respect, however, it seems to have failed, not because it is not effective against amebæ, but because pyorrhea is not caused by these organisms.

The causes and treatment of pyorrhea alveolaris and the relation of emetine to the disease are well summarized in the following conclusions of Roddy, Funk and Kramer:²

1. Pyorrhea alveolaris is not a specific disease; its chief etiological factors are:

(a) An excessive bacterial flora of the mouth; (b) deviations from normal of the affected tissues brought about by certain diseases.

2. Oral sepsis is the first stage of pyorrhea; the etiology of both is the same.

3. Pyorrhea can be prevented by regular cleansing of the mouth and teeth.

4. The detection of all etiological factors in the majority of cases of pyorrhea requires a thorough dental and medical examination. Whenever possible an x-ray examination should be made.

5. Acute recurrent gingivitis, or chronic gingivitis, or a persistent excessive bacterial flora of the mouth is a clinical sign of this disease.

6. Systemic complications are rare in the early stages and frequent in the late stages.

7. Coincident systemic diseases are frequently associated with pyorrhea.

8. There is no specific method of treatment.

9. The three indispensable factors in the treatment are: (a) training the patient to regularly cleanse the mouth and teeth; (b) the institution of whatever dental treatment may be indicated; (c) medical treatment of coexisting systemic disturbances or disease.

10. Emetine may well be employed as an adjunct on the principle that it will do no harm and may possibly, in some cases, be beneficial.

11. When infectious systemic complications exist an autogenous vaccine is indicated, and even in uncomplicated cases will at times accelerate improvement.

Mention has been made in previous issues of PROGRESSIVE MEDICINE of the use of emetine in respiratory infections, and particularly in *tuberculosis*. Its use under these circumstances was probably due to the fact that ipecac has always been considered an expectorant. Under these circumstances, emetine might be used, although its toxic properties would make it much less desirable than other harmless drugs possessing expectorant qualities. Reed³ has reviewed its use in respiratory conditions. In regard to its use in tuberculosis he summarizes his conclusions as follows: Insofar as emetine has a beneficial action in tuberculosis, it would seem to be due to its expectorant properties,

¹ Archives de Médecine des Enfants, January, 1917.

² New York Medical Journal, September 2, 1916.

³ Boston Medical and Surgical Journal, September 14, 1916.

and, if so, other preparations are preferable. Insofar as emetine has a beneficial action in hemorrhage, it would seem to be due to the indirect result of decreasing blood-pressure, and, if so, other drugs would be more effective in that they would produce a similar result more safely and without the specific action of emetine on coagulation. As I have repeatedly stated, the use of any drug in pulmonary bleeding is uncertain, and more often it fails than succeeds. Any hemoptysis that is serious enough to require active measures for its control should be treated by means of artificial pneumothorax. This is the only sure means I know of. It is the only method in which one can foretell with any certainty that the bleeding will stop.

In the treatment of *pellagra*, Raines¹ states that he employs emetine in all cases in which the diarrhea is persistent, and particularly if there is blood in the stools. Emetine hydrochloride is given in 1-grain doses every other day or until the abnormal discharges cease. He states that one dose is frequently sufficient to stop the diarrhea.

Ether. I have called attention a number of times to the irritant effects of ether on the respiratory tract and its dangers in cases of *pulmonary tuberculosis*. The belief that ether is contra-indicated in cases of apparent or suspected pulmonary tuberculosis is quite generally conceded by phthisiotherapeutists and is becoming more and more recognized by surgeons. In view of this belief one is surprised to note that the inhalation of ether is deliberately advocated as a curative measure in these cases. Savage² states that the inhalation of ether is valuable in the treatment of peritoneal, pulmonary, and meningeal tuberculosis, and that it is especially to be recommended in uncomplicated tuberculous peritonitis and early pulmonary tuberculosis. One anesthesia usually suffices. In advanced cases it relieves the distressing symptoms of high fever, cough, expectoration, night-sweats, and loss of sleep and appetite. Mention is made of this observation only to warn against its dangers.

Fresh Air. In an address on the use of fresh air in the treatment of the *acute infectious diseases*, Freeman³ points out that there is now a general acceptance of the advantages of fresh air, excepting perhaps in measles and scarlet fever. Of the advantages in tuberculosis there can be no doubt. In pneumonia the results from this treatment, according to Freeman, have exceeded those from any other method of treatment, including specific treatment, with serums and vaccines. He states that there are many men, however, who, while allowing that fresh air is beneficial in an inflammation of the lung, doubt its efficacy in bronchitis, pharyngitis, laryngitis, rhinitis, and otitis. Freeman believes that the only reason why there is doubt is because the method has not been tried in these conditions. He himself has subjected all these conditions to the fresh-air treatment, and believes firmly that it is of direct benefit and that it materially diminishes the mortality.

Another article on the treatment of *pneumonia in children* by means

¹ Memphis Medical Monthly, February 1, 1917.

² Ohio State Medical Journal, July, 1917.

³ American Journal Diseases of Children, December, 1916.

of fresh air has been contributed by Morse and Hassman.¹ This last-mentioned article is the subject of two editorial comments. Morse and Hassman came to the conclusion that those who attributed good results to this method were influenced in their observations by "merely their impressions, and are therefore of little or no scientific value."

The *Journal of the American Medical Association* (January 6, 1917), in commenting on Morse and Hassman's paper, recalls the observations of Howland and Hoobler to the effect that the real benefit of the fresh air is its coldness. It is the cold that is of benefit, because it leads to a rise in blood-pressure. In warm weather no such good effects are noted. The editorial in question agrees with the writers just mentioned that "impressions" are of little or no scientific value. On the other hand, Hare,² in an editorial comment on the same article, criticizes the method by which Morse and Hassman drew their conclusions: (1) as to whether the pneumonia was lobar or lobular, and if the latter, whether it was a complication of measles or some other infection; (2) the research consisted not in studying two series of cases occurring simultaneously, one series being treated indoors, another outdoors, but by changing the treatment, the children being put out of doors for a varying number of hours, brought back into the ward again, put out again and so on. In regard to "impressions" as to the value of the treatment, Hare insists that such observations on the part of trained and experienced clinicians cannot be ignored and swept aside. And with this I agree. There is much in medicine that is not amenable to scientific analysis, and in no instance is this truer than the judgment as to how sick a patient is. The experienced physician can often detect evidences of improvement or indications of danger which the less experienced, even with the aid of modern scientific methods, fails to see. To this extent medicine is an art and not a science. At any rate, if it has accomplished nothing else, the so-called fresh-air method has revolutionized the ventilation of hospital wards. It is not often nowadays that twenty or more patients are found in a ward with the temperature of 80° F. or more.

The relationship of *climate* and *tuberculosis* has been considered at length a number of times in these pages. Of recent years the literature has contained few articles on the subject. Fish,³ in discussing the subject, states that in the final analysis we are treating not consumption but the consumptive; and, above all, we are to remember that there is no one best climate for all cases, and that some patients will fare well in any fairly good climate providing they adhere to a suitable mode of life.

Heliotherapy. The utilization of the sun's rays in the treatment of various affections is now a well-recognized procedure, especially in the treatment of *surgical tuberculosis*. Moncorvo⁴ reports gratifying results in the treatment of tuberculosis of the bones, skin diseases, atonic ulcers, and secondary anemia.

¹ American Journal Diseases of Children, November, 1916.

² Therapeutic Gazette, March, 1917.

³ Medical Record, September 30, 1916.

⁴ Brazil-Medico, April 7, 1197.

Maffi¹ warns that in the treatment of tuberculous cases care must be exercised to see that the exposures are not too prolonged, otherwise there is danger of overflowing the organism with the toxin set free.

In the treatment of exhausted and wounded soldiers returned from the front the benefits arising from the use of heliotherapy have been very marked. The men bask in the sunlight, with enjoyment, and thrive much better than those not taking the heliotherapy.

Hexamethylenamin. This drug has gained an important place in the treatment of infections of the urinary tract. In employing it, however, it is to be borne in mind that it is not without danger, and due consideration must be given to the proper indication and contra-indication for its use.

The drug is recommended² under the following conditions: It is of great value as a prophylactic in operations on the urinary organs. It is valuable in the treatment of *cystitis*, *pyelitis*, etc. It is also employed as a prophylactic in the bacilluria of typhoid fever. Some recommend its routine use to prevent the occurrence of this complication. It has also been recommended in the treatment of scarlet fever in order to prevent the occurrence of nephritis. Inasmuch as hexamethylenamin has produced albuminuria and hematuria in some cases it should be used with caution if acute inflammation of the kidneys is present or anticipated.

G. G. Smith³ states that in a study of its use in a limited number of cases of *nephritis* it would appear that serious disease of the glomeruli greatly decreases the ability of the kidneys to excrete hexamethylenamin. He states, however, that the diminished excretion of the drug in chronic glomerulonephritis does not affect the position of hexamethylenamin in the treatment of renal affections, because, according to Cabot and Crabtree, colon infection affects the epithelium of the tubules. Excretion of hexamethylenamin by the glomeruli is not interfered with, and the drug is put out in good quantity. In a study of the output of hexamethylenamin by infected kidneys, Smith has presented facts drawn from a study of 10 cases of undoubted renal disease of this type. In every case the drug was excreted; in 3 cases, in a strength of 1 to 10,000; in 2, 1 to 30,000; in 1, 1 to 40,000. It was weaker in the other 4, although strong enough to give a definite test of its presence. In chronic nephritis of advanced degree he found in 3 cases a diminution in the output of hexamethylenamin, which would be a serious factor in its employment as a therapeutic agent. Fortunately, in such cases, it is rarely employed. In kidneys damaged by infection, even to a very marked degree, the drug may be excreted in a strength as high as 1 to 10,000. Hexamethylenamin is useless as a bactericide unless it is broken up into formaldehyde by urine which is definitely acid.

In a clinical lecture on the treatment of *pyelitis in infancy*, Abt⁴ emphasizes the following facts: The child should be under continuous

¹ Policlinico, August 13, 1916.

² Useful Drugs, Published by American Medical Association, 1916.

³ Boston Medical and Surgical Journal, October 19, 1916.

⁴ Medical Clinics of Chicago, 1917, ii, 904.

observation and the drug should not be continued for an extended period. The urine should be frequently examined for the presence of blood. Abt states that more than once he has seen severe and fatal nephritis develop, which, in his opinion, was due to the overuse of hexamethylenamin. If the drug is given to infants under one year of age it should be administered in 1-grain doses followed by water. This may be repeated four or five times daily.

Hydrogen Peroxide. In the treatment of *mercurial stomatitis*, Montgomery¹ regards hydrogen peroxide as almost a specific. *Perhydrol*, which is a 30 per cent. solution of hydrogen peroxide, and is free of acid, may be used. It has the disadvantage, however, of being expensive, a matter of some importance, as the free use of the mouth wash is essential. Another disadvantage is that it is liable to explode. Scholtz recommends the following:

R—Sol. perhydroli 5.00
 Aquæ ad. 200.00

M. Sig.—A teaspoonful in a half or a full glass of water as a mouth wash several times a day.

As hydrogen peroxide is one-tenth the strength of perhydrol the following prescription may be substituted:

R—Hydrogen peroxide 50.00
 Aquæ ad. 200.00

M. Sig.—A teaspoonful in a half or a full glass of water.

If the gums become more affected, as in *pyorrhea alveolaris*, undiluted hydrogen peroxide may be directly applied, or a mixture of equal parts of peroxide and a 20 per cent. solution of silver nitrate.

R—Hydrogen peroxide,
 Sol. Argent. nitrat (20 per cent.) āā 10.00

M. Sig.—Apply with a cotton swab.

Intravenous Medication. In a review of this subject, Eggleston² concludes that it is a method of considerable value in a very limited number of conditions and for a very limited number of agents. It is to be borne in mind that it is the most difficult of all methods, and that it is associated with a number of dangers more or less difficult to avoid. In Eggleston's opinion the method is still in the experimental stage, and is, as yet, not suitable for general adoption. He has reviewed the subject in the hope of determining something of its advantages, disadvantages, limitations, and its safety and the precautions which must be observed in its practice.

Advantages. 1. Intravenous injection eliminates the factors of absorption and possible destruction or alteration.

2. The dose therefore may be gauged with greater precision.

3. The actions of some drugs can be secured almost immediately when given intravenously, and it is therefore valuable in certain emergencies.

¹ Medical Record, November 18, 1916.

² International Clinics, Twenty-seventh Series, 1917, ii.

4. By intravenous injection valuable actions may be secured which cannot be obtained by other methods or which can be secured to a limited degree only.

5. Certain drugs which cannot be given satisfactorily by other methods may be administered intravenously.

6. Under certain conditions of disease it may be the only method yielding the desired results with any measure of certainty.

Disadvantages. 1. The technic is more complicated than for any other method.

2. Its field of application is limited to a comparatively small number of agents and by certain conditions in the patient, such as obesity, debility, infancy, serious vascular or cardiac changes, etc.

3. Its practice is fraught with certain dangers, such as local or distant thrombosis, embolism, infection, deleterious effects of concentrated solutions on the heart or central nervous system, pulmonary edema, etc.

4. It is not suitable for prolonged courses of treatment.

5. The occurrence of unsuspected side actions and the difficulty of determining the dose in the case of drugs not previously used intravenously make its extension a matter of difficulty and often danger.

6. It is often not a safe mode of administration in ambulant cases and for use in the office.

Precautions. 1. Perfect asepsis on the part of both operator and field of operation.

2. Perfect solution or proper form of suspension of the drug.

3. The use of freshly distilled water for the solutions.

4. The use of needles of proper size and preferably new.

5. Mastery of the technic so as to avoid transfixion of the vein, slipping of the needle, etc.

6. Avoidance of air-bubbles in the injecting system.

7. Proper selection of patients for several agents, to avoid serious accidents.

8. Avoidance of injections of too large amounts of liquid.

9. Maintenance of the injection fluid at proper temperature when considerable amounts are to be given.

10. Preliminary preparation of patient by catharsis and diet in the case of certain agents.

A paper somewhat similar in its scope has been contributed by Larned.¹ He has considered in detail the technic to be observed and has greatly enhanced his description by a number of splendid illustrations. For those who have had no experience with the method the original paper should be consulted, as the description does not lend itself readily to condensation. Larned urges the more general use of the intravenous method for the following reasons:

It is realized that the average American medical man will consider this method a dangerous therapeutic innovation and regard it with suspicion. I am very sure, however, by reason of close observation and considerable experience, that this form of medication deserves the very serious attention of the American medical profession.

¹ Therapeutic Gazette, October, 1916.

The physician who makes use of it will soon learn that the intravenous route is decidedly advantageous to the patient, since the medication is not subjected to influences that may reduce its potency or interfere with its physiological action. Certainty and directness of action are secured by this method of application.

Intravenous injection should be employed without hesitation when the case is urgent or the tissues edematous, or the circulation is so feeble that absorption is slow.

When a drug suitable for the purpose is injected, its physiological and therapeutic effects are produced in the fullest degree in the shortest time and in the most characteristic form. Just as the subcutaneous administration of solutions in many instances is superior to their administration by mouth, so the intravenous injection is better than the subcutaneous. Some of the advantages of intravenous medication may be stated as follows:

The dose is usually smaller (a fraction, one-half, or even less) than the amount necessary to produce an equivalent effect by the oral route.

The effect is prompt, sometimes immediate, and usually may be accurately estimated.

The patient is spared the disagreeable taste, gastric distress, and psychic effects of drugs given by the mouth, and likewise the local reaction, swelling, induration, and pain incidental to hypodermic injections are not seen after properly made intravenous injections.

Iodine. Kendall's¹ clinical studies of the function of the *thyroid gland* have shown that the entire activity of the thyroid is manifested by the administration of *alpha-iodine*, a crystalline compound, alone. There appears to be no other substance in the thyroid secretion which acts directly. Alpha-iodine, given in very small amounts, will supplant thyroid activity, relieving the conditions of *myxedema* and *cretinism*, and in excess will produce symptoms simulating exophthalmic goitre.

The use of iodine in one form or another has long been regarded as of value in the treatment of tuberculosis. Recently, the use of the tincture has been advocated in the treatment of pulmonary cases. Boudreau² claims to have obtained excellent results from the use of the tincture given in ascending doses. He begins with several drops a day and gradually increases it. In many instances tremendous doses can be tolerated.

Waller³ advises the use of the *tinctura iodi mitis* of the *British Pharmacopœia*, in doses of 2 minims three times daily in peppermint water. He has found this preparation specially useful as a tonic for children with a tuberculous tendency. For the last year or so I have used, in a limited number of cases, the ordinary tincture of the *United States Pharmacopœia*. The dose is started with from 1 to 3 drops and increased 1 drop daily until the dose reaches 15 to 20 drops a dose. The iodine should be well diluted in water or milk. In some instances it has seemed to exert a favorable influence on the cough and reduced the amount of expectoration. In others no effect whatever was noted.

¹ Boston Medical and Surgical Journal, October 12, 1916.

² Journal de Médecine de Bordeaux, June, 1917.

³ The Prescriber, April, 1917.

It can be recommended, but is open to the same criticism that applies to so many of the drugs used in tuberculosis, namely, that it will fail quite as often as it will succeed.

Kaolin. The problem of the *diphtheria bacillus carrier* has engaged a good deal of attention in the past few years and a variety of methods have been recommended to rid the throat of these organisms. Two years ago fuller's earth, or kaolin, was first brought forward, and the results reported then and again last year seemed to indicate that at last a simple and efficient method had been discovered. Lately, however, the reports do not seem to be so encouraging. Stengel,¹ in discussing the treatment of carriers and the persistence of bacilli in the throat diphtheria, states that he has had good results with kaolin. The kaolin may be either sprayed in the throat in powder form or it may be made into a paste of thick consistency and applied to the throat with a swab.

Bell² has reported 8 residual cases treated with kaolin. The longest time in obtaining the successive negative cultures was thirteen days; the shortest time, one day. He applied the kaolin in powder form by spraying the nose and throat every three hours, or by having the patient eat $\frac{1}{2}$ dram every hour. The latter method seemed to give the best results. In comparing the kaolin treatment with fresh cultures of the *Staphylococcus pyogenes aureus* he favors the latter method. He found the *staphylococcus spray* particularly advantageous in nasal cases.

Rabinoff³ thinks the problem of the diphtheria bacillus is still unsolved. She studied the effects of a variety of methods which have been recommended, without, however, obtaining anything like consistent results with any of them. Her conclusions are as follows:

1. In the group of 80 diphtheria carriers which were studied it was found that a certain number became negative irrespective of the treatment employed. No better results were obtained with iodized phenol or with fuller's earth than with the silver preparations or other antiseptics. Indeed, those cases which were not treated in any way did equally as well. An exception must be made only as regards the results obtained with fuller's earth in adults, which were fairly satisfactory.

2. The real problem of the carrier lies in the ultimate group in which bacteria persist in spite of all local treatment.

3. The presence of a foreign body in the nose may provide a favorable environment for the growth of the diphtheria bacilli.

4. Removal of tonsils and adenoids seems to offer a safe and rapid method of eliminating diphtheria bacilli from the nose and throat of carriers, and should finally be resorted to when other methods have failed.

In addition to its use in cases of diphtheria carriers, kaolin has been recommended in various intestinal affections.

Wiese⁴ after trying kaolin in the treatment of *dysentery* gave it up

¹ Pennsylvania Medical Journal, March, 1917, p. 394.

² Archives of Pediatrics, November, 1916.

³ Journal of the American Medical Association, December 9, 1916.

⁴ Deutsche Med. Wchnschr., November 23, 1916.

as unsatisfactory. The patients took it with extreme repugnance and complained afterward of uncomfortable sensations in the abdomen. If its use were persisted in it often caked into hard lumps in the intestines, and these lumps caused pain and irritation as they passed along. In some instances these caked masses became as large as a hen's egg, and extremely hard.

Kephalin. Surgeons have for a long time sought some means to combat *hemorrhage* which is not controllable by means of ligatures. Such hemorrhages are usually of the oozing type in which there is a slight, but continuous, leakage, and which in the aggregate causes a very considerable loss of blood. Packing such bleeding areas firmly with gauze has been the only means of controlling such hemorrhages, and this method has never been entirely satisfactory. A method has finally been discovered, the clue to which was furnished by Prof. Howell, of the Johns Hopkins University, who showed that certain lipoids exert a thromboplastic action. The factor ordinarily lacking in fluid blood to make it clot promptly is available thrombin. Although thrombin is ordinarily present in blood, it is probably, at times, inhibited in its action by some antagonistic substance—antithrombin; or it may be that some additional substance is needed to activate it. Brain lipid seems to be the most valuable substance as an activating agent. Hirschfelder¹ has prepared an active thromboplastic preparation from an ether extract of ox brain, and Cecil² has prepared a similar substance from the brains of hogs. At Cecil's suggestion a commercial kephalin is now prepared by Armour & Co. In Young's clinic, at Johns Hopkins University, the need of a hemostatic to control bleeding in deep-seated operations, such as perineal plastectomies, in which bleeding occurs within the prostatic capsule, has long been recognized. Kephalin has supplied this want. Their method is described by Cecil³ as follows: The kephalin is dissolved in an excess of ether, about 5 per cent. solution being made, and this concentrated kephalin solution is poured over gauze strips six feet long and six inches wide. The packs are then folded, rolled, wrapped in two muslin covers, and sterilized in the steam autoclave at a temperature of 120° C. for ten minutes. The heat necessary to sterilize them effectively does not interfere with the coagulation action of the kephalin. Following the use of kephalin gauze, Cecil states that it became evident that the hemorrhage ceased much more quickly than when iodoform gauze was used, and that it was unnecessary to introduce so much gauze or to pack it as tightly as formerly. Another effect was that the postoperative bleeding which came through the bladder drainage tube diminished rapidly. The gauze has been employed in this clinic in 34 prostatectomies. Cecil draws the following conclusions:

1. Kephalin causes a quicker and firmer clot.
2. Not as much pressure in packing is required to control hemorrhage as when plain or iodoform gauze is used.

¹ Science, August 18, 1916.

² Journal of the American Medical Association, February 24, 1917.

³ Loc. cit.

3. When the packs are removed, the clot is of sufficient firmness to prevent bleeding. This is not true of other packs.

Young¹ in commenting on these results states that active hemorrhage and slow oozing, which together amount to considerable loss of blood in a few cases, have been well recognized complication after all forms of *prostatectomy*. In perineal prostatectomy, although the gauze packs can be placed so that bleeding rarely does any harm, there are instances in which the mass of gauze needed to control the bleeding is objectionable, particularly when the time came for its removal.

Kephalin is also known as *thromboplastin*. Hess² has reported further experience with this hemostat. He states that tissue juice made from brain has proved itself of practical value in controlling hemorrhage whenever it can reach the site of bleeding. In cases of true *hemophilia*, it may be regarded almost as a specific hemostatic. It is to be recommended for local use in the bleeding of the newborn, in nasal hemorrhage, and in parenchymatous bleeding associated with various operations. When local applications fail it should be injected into the site of hemorrhage, as in bleeding from the gums following tooth extraction. This method can readily be resorted to, as thromboplastin solution loses but little of its potency as the result of dilution and cursory boiling. Hess states that a more extended experience is needed to determine its usefulness in connection with hemorrhage from the gastrointestinal tract. It can be given by mouth in considerable dosage and would therefore seem to be indicated in bleeding from the stomach and upper intestine. In addition to its hemostatic properties, tissue extract has been found to possess healing properties, actively stimulating granulation tissue and hastening epithelialization. It may therefore be used as a dressing for torpid ulcers and sluggish wounds.

Mercury. Within the past few years it has become increasingly apparent that the use of mercury as a means of suicide has assumed alarming proportions. In *PROGRESSIVE MEDICINE* for 1915, I quoted some figures relative to Italy which show that in that country the practice of using mercury for suicidal purposes had become extremely prevalent. As a result, there has been, within the last few years, a very large literature on the subject of *mercurial poisoning*. The lesions produced by the drug have been carefully studied, and, in addition, there have been numerous articles dealing with the treatment of the condition.

The preparation most generally used is the bichloride of mercury or mercuric chloride. The danger arising from the ease with which bichloride tablets may be obtained has been repeatedly emphasized. Not only can anyone, who wishes to bring about a self-inflicted death readily obtain these tablets, but, in addition, they are a constant menace by reason of their being purchased, without a prescription, by those who wish an antiseptic substance. Being kept in the house they are not infrequently taken by mistake for other drugs.

¹ Loc. cit.

² Journal of the American Medical Association, December 9, 1916.

In an article published several years ago, Lambert and Patterson¹ pointed out that the striking peculiarities of mercurial poisoning are (1) an initial toxic gastritis and stomatitis which quickly follows the ingestion of the poison; when the vagina is the point of entrance a severe vaginitis develops; (2) an intensive and often fatal ulcerative colitis; (3) the later manifestations, especially a more or less complete anuria, which may persist. The anuria usually arises on or about the fourth day after the ingestion of the poison. Death may then occur from lesions of the liver or colon, with or without the reestablishment of the urinary secretion.

In an experimental study, MacNider² found that the acute kidney lesion, which develops as a late manifestation, does not show any dependence, in the frequency with which it occurs, on the severity of the colitis. In his opinion the delayed kidney injury in mercurial poisoning has been constantly associated with the development of an acid intoxication. The severity of the damage to the cells of the convoluted tubules and the extent of fatty infiltration in the cells of the ascending limb of Henle's loop show a correlation with the degree of acid intoxication.

Weiss³ accepts the colloidal swelling hypothesis of Fischer,⁴ who believes that the evidences of acute nephritis are merely an indication of what is going on throughout the body. Just as the kidneys are swollen so are the other tissues swollen. When we find albumin, casts, and blood in the urine we may be reasonably sure that the other organs have undergone damage similar to the kidneys; that is, the kidneys do not pass any water along as a result of severe cloudy swelling and edema. Then many of the symptoms appear, as nausea, vomiting, headache, probably depending on edema of the brain.

As a result of their experimental studies, Burneister and McNally⁵ reach the following conclusions in regard to the kidney lesions:

1. Mercury can be detected chemically, frequently quantitatively, in the blood of animals poisoned with mercuric chloride within a few minutes after it is administered.

2. Degenerative changes, leading to individual cell death, take place rapidly in the kidney and occur simultaneously with the presence of mercury in the circulating blood.

3. In massive intoxication, immediate renal changes vary with the size of the dose. Hepatic changes vary as the duration of the intoxication. In the smaller doses, renal changes vary as the duration of the intoxication.

4. The degree of renal or hepatic degeneration does not necessarily vary directly as does the amount of mercury contained in the circulating blood.

In estimating the renal function in these cases, Lewis⁶ states that the

¹ Archives of Internal Medicine, November, 1915.

² Proceedings of the Society of Experimental Biology and Medicine, 1917.

³ Journal of the American Medical Association, June 2, 1917.

⁴ Edema and Nephritis, 1915.

⁵ Journal of Medical Research, March, 1917.

⁶ Bulletin of Johns Hopkins Hospital, July, 1916.

specific gravity curve is a valuable index of renal function. Fixation of the specific gravity is seen only at the height of renal insufficiency. The variations in the concentration of the urine become more and more marked as the renal function approaches normal. The acute course of the intoxication is shown by the various functional tests. Even after six days of anuria the kidneys may regain a practically normal functional capacity within twelve days of the reestablishment of the urinary secretion and all trace of anatomical damage disappear from the urine in less than three weeks. Lewis emphasizes the necessity of prolonged and vigorous treatment of every case of bichloride poisoning. Many apparently moribund individuals have been saved by properly directed and vigorously pushed therapeutic measures. Death should be the only indication for a discontinuance of treatment prior to complete recovery of the patient.

In the treatment of mercurial poisoning, the eliminative method of Lambert and Patterson¹ has met with great success. Although modified in some particulars by others the underlying principles of this treatment have been retained. The eliminative method is justified by the knowledge that gastro-intestinal symptoms arise even when the mercury is absorbed from some region not connected with the alimentary tract (as, for instance, the vagina). This indicates the effort of the organism to excrete the poison through the bowel. Furthermore, mercury has been found in the stomach several days after the introduction of the poison. Both the gastritis and colitis therefore make it rational to aid in the riddance of the poison by means of lavage and colonic irrigations.

The eliminative method has the following features: (1) Prolonged gastric lavage; (2) colonic irrigations; (3) diuretics in the form of a mixture of potassium bitartrate, sugar, and lactose; (4) potassium acetate by proctoclysis; (5) daily hot packs. In carrying out this treatment the stomach is washed out twice daily, and, in addition, two colonic irrigations are given daily. The patient is given 8 ounces of milk every two hours, which is alternated every two hours with 8 ounces of the following mixture: potassium bitartrate 1 dram, sugar 1 dram, lactose $\frac{1}{2}$ ounce, lemon juice 1 ounce, boiled water 16 ounces. To supplement this large amount of fluid by mouth a solution of potassium acetate (1 ounce to a pint of water) is given continuously by rectum. To further promote elimination a daily hot pack is also given.

Weiss² uses practically the same method, modifying it slightly by the free use of alkalis. This he does to overcome the general colloidal swelling, which is believed by Fischer³ to be the essential lesion. Weiss describes his method as follows: The treatment begins on the arrival of the patient, which is usually within a few hours after the drug has been taken. The stomach is washed out with one quart of milk and the whites of three eggs, followed by water. A sample of the gastric contents is saved for examination. Before the stomach-tube is removed, 3 ounces of magnesium sulphate in 6 ounces of water is introduced and allowed to remain in the stomach. The patient is then given a soapsuds

¹ Loc. cit.

² Loc. cit.

³ Loc. cit.

enema. The enema and catharsis rapidly open the gastro-intestinal tract, thereby aiding in the elimination of mercury. If the patient did not vomit immediately after swallowing the poison, and did not reach medical aid for at least three hours later, an intravenous injection of Fischer's solution¹ is given at once in amount ranging from 1000 to 1500 c.c., depending on the condition of the heart of the patient. If there is no evidence of cardiac derangement, 1500 c.c. of fluid intravenously are readily tolerated without any disturbance. Then the patient receives from six to eight glasses of "imperial drink"² a day, and he is given large quantities of water by mouth. In regard to diet, the patient is fed liberally, being allowed almost anything, except an excess of protein food.

Weiss uses the analysis of the urine as the control of the treatment. The patient should void large quantities of urine, as he is taking large amounts of fluid. It is endeavored to keep the urine alkaline to a saturated solution of methyl red in alcohol. Weiss states that Fischer has shown that if the urine of a nephritic cannot be made alkaline to methyl red this patient continues in a dangerous state.

Weiss reports a series of 15 cases personally treated by this method and 10 similarly treated in other parts of the hospital (July, 1915, to June, 1917). Of these 25 patients, all were discharged free from any discoverable symptoms of mercurial poisoning. There were no fatalities. The amount of mercury taken by these patients, according to their own statements, varied from 3 to 82 grains of mercuric chloride, all taken by mouth. Since the article was written, Weiss states that 3 additional cases have been treated, with one death.

A case successfully treated by the Lambert-Patterson method is reported by Brown and Baskett.³ Their case illustrates the danger of allowing the laity to obtain and use bichloride tablets. A woman, who had finished menstruating, inserted into the vagina, following her usual custom, what she supposed was an astringent tablet. This proved to be a $7\frac{1}{2}$ -grain bichloride tablet. Violent constitutional symptoms developed, and only the most vigorous treatment brought about her recovery.

A case in which recovery followed the use of large quantities of water is reported by Thorington.⁴ Shortly after the ingestion of a $7\frac{1}{2}$ -grain bichloride tablet the stomach was washed out with 3 gallons of water through a stomach-tube. The first returning water showed some blood. Following the lavage, several eggs were given and these were retained. In addition, stimulants were given to overcome the shock. The patient was given a tumblerful of water every twenty minutes, making a total

¹ Fischer's solution consists of sodium carbonate crystals 10 grams, and sodium chloride 15 grams to 1000 c.c. of water.

² The modified "imperial drink" consists of potassium bitartrate, 60 grains; sodium citrate, 30 grains; sugar, 60 grains, with lemon or orange juice to taste, to 8 ounces of water. This makes a pleasant alkaline drink, which is best made by placing the potassium bitartrate and sodium citrate into the lemonade just before it is used.

³ Journal of the American Medical Association, June 2, 1917.

⁴ Southern Medical Journal, December, 1916.

in twenty-four hours of about 3 gallons. Each day the amount of water was lessened.

Fantus¹ has made a study of the various mercurial antidotes. He first established the fatal dose of the drug for rabbits, and determined the average length of life of the animals after they had been poisoned. He then determined the influence of the various antidotal measures when applied at the time the poison was administered or subsequently. In his opinion eggs are of little value unless given immediately after the poison is swallowed; milk and serum albumin are worthless; Hall's solution (potassium iodide and quinin) is useless; sodium carbonate has no effect; sodium bicarbonate and sodium acetate have a moderate antidotal value, but potassium bitartrate and sodium sulphate have no value. Sodium phosphate alone has no antidotal value, but mixed in a certain proportion with sodium acetate it has some effect. His best results were obtained with an antidote composed of 1 part of sodium hypophosphite and 5 parts of hydrogen peroxide. This combination of reducing an oxidizing agent has no chemical justification, but his results were uniform, and he suggests the explanation that peroxide acts as a catalyzer. Fantus advises that if the amount of the poison taken is known, ten times as much of the hypophosphite should be given as poison taken. As this might require a harmful amount of the hypophosphite, copious lavage should be employed immediately, to be followed with a very dilute solution of the antidote. This may be followed by a safe dose of antidote, which is to be retained, and which might be repeated every eight hours for several days. He insists that the elimination treatment as advised by Lambert and Patterson should not be neglected.

In the course of some chemotherapeutic investigations, Schamberg, Kolmer and Raiziss² have elaborated a number of new mercurial compounds. One of these compounds (No. 99, or sodium oxymercury-*arthonitrophenolate* or *mercuropfen*) has been shown to be especially available as a local antiseptic and germicide. Compared with mercuric chloride it is found to be many times as efficient. Their results are epitomized in the following conclusions:

1. Mercurial compound No. '99, sodium oxymercury*arthonitrophenolate* (*mercuropfen*), exhibits against the *Staphylococcus aureus*, in the "antiseptic test," fifty times greater activity than mercuric chloride; it destroys these bacteria on prolonged exposure in bouillon in a dilution of 1 to 10,000,000.

2. In a menstrum of ascites fluid, *mercuropfen* is 200 times more germicidal against the *Staphylococcus aureus* than mercuric chloride.

3. By the Rideal-Walker method, *mercuropfen* exhibits 10,000 times greater germicidal power against the *Bacillus typhosus* than phenol, and over thirty times greater activity than mercuric chloride.

4. *Mercuropfen* disinfects the hands in dilutions of from 1 to 10,000 to 1 to 40,000 in one minute, whereas mercuric chloride in a dilution

¹ Journal of Laboratory and Clinical Medicine, September 1, 1916.

² Journal of the American Medical Association, May 19, 1917.

of 1 to 50,000 requires over five minutes and in a dilution of 1 to 10,000 requires over fifteen minutes.

5. Mercuraphen sterilizes ordinary rubber tubing in thirty minutes in a dilution of 1 to 100,000. Mercuric chloride accomplishes this result in a dilution of 1 to 16,000. With tubing heavily infected with cocci and spores, mercuraphen requires a 1 to 500 solution and mercuric chloride fails in a 1 to 50 solution.

6. Mercuraphen in a 1 to 5000 solution sterilizes feces in thirty minutes, mercuric chloride accomplishes this result in a 1 to 2000 solution.

7. The precipitating effect of mercuric chloride on human serum proteins is four or five times greater than that exhibited by mercuraphen. This is an obvious advantage possessed by the later substance.

8. Solutions of 1 to 5000 of mercuraphen exhibit no evidence of tarnishing on nickel-plated instruments after twenty-four hours' exposure.

9. In experiments not detailed here, mercuraphen administered intravenously in rabbits has a lower toxicity than mercuric chloride.

In the case of extensive *dropsy* or edema due to *cardiac disease*, Robert Abrahams¹ recommends *calomel* as the ideal drug. He gives 3 grains three times a day for three days in succession. Given in this dosage and for this length of time it acts as a diuretic. At the end of three days the patient begins to pass enormous quantities of urine. The calomel may, and perhaps should be, combined with 10 grains of bicarbonate of sodium, as the addition of the latter helps to prevent ptyalism.

Morphine. In the management of patients suffering from *failing compensation*, Robert Abrahams² emphasizes the value of morphine. This drug has to be resorted to frequently in these cases. It is of the greatest service if orthopnea is present. According to Abrahams, morphine, together with digitalis, never fails to relieve and improve the terrible hunger for air, the tightness of the chest, and the horrible choking sensation that go with shortness of breath. In the management of the terminal stages of heart disease, Abrahams ranks morphine as the equal of digitalis, and at times its superior. A combination of the two drugs is often invaluable.

In some forms of cardiac disease, particularly aortic incompetence, extreme nervousness and sleep, which is broken at frequent intervals, are often exhausting to the patient. Many years ago I learned, from the late John H. Musser, that nothing was so efficient for the relief of these conditions as small doses of morphine. Morphine, $\frac{1}{24}$ grain, hypodermically, will often give the patient several hours of unbroken sleep.

In view of the highly developed blood and lymph supply of the eye and its appendages, Macht³ thinks it is remarkable that so few cases of drug absorption through the conjunctiva and lacrimal apparatus have been recorded. Pharmacological investigations which he has made on opium alkaloids strikingly establishes the fact that certain drugs can be quickly absorbed through the conjunctiva. If a few milligrams of *apomorphine hydrochloride* are sprinkled into the eye of a dog, and the

¹ Therapeutic Gazette, July, 1917.

² Journal of the American Medical Association, April 28, 1917.

³ Ibid.

animal is held still for a minute or two in order to allow the drug to dissolve, emesis follows in from two to five minutes. The same phenomenon is produced by the instillation of a few drops of a 1 or 2 per cent. solution of apomorphine. In all his experiments care was taken to eliminate any possibility of the animal's absorbing the drug by licking. As vomiting is produced in dogs almost as easily with morphine as with apomorphine the same experiments were tried with the former drug. After the application of the morphine into the conjunctival sac, emesis also occurred, although after a somewhat longer interval (five or more minutes). Macht believes that these experiments should serve to emphasize the possibility and importance of drug absorption through the conjunctiva, and to render the ophthalmologists more cautious in the employment of toxic alkaloids.

Macht¹ claims that morphine produces an increase in tonicity and in the rate of contractions of the ureter. Papaverine and narcotine produce a relaxation of the tonus of the ureter and an inhibition of its contractions. Therefore opium and other combinations of total opium alkaloids contain sufficient papaverine and narcotine to overcome the spasmodic local effect of morphine and are to be preferred to morphine in cases of *ureteral colic*.

Optochin (Ethylhydrocuprein). Moore and Chesney² report on a series of 32 cases of *acute lobar pneumonia* treated with this drug. When optochin is given by mouth to patients suffering from pneumonia in such amounts that they receive at least 0.024 gram per kilogram of body weight in twenty-four hours, and when the size and spacing of the individual doses are adequately regulated, a specific pneumococidal action appears in their blood within a few hours, and it can be maintained more or less constant for several days. In order to maintain this constant level the intervals between the individual doses by mouth should not ordinarily exceed about two and a half or three hours. Administration by mouth appears to be more satisfactory than intramuscularly. The pneumococci, not only *in vitro* but also in the human body, in patients treated with ethylhydrocuprein may acquire the property of more or less complete resistance or "fastness" to the drug.

Moore and Chesney call attention to the fact that *toxic symptoms*, such as tinnitus, deafness, amblyopia, or amaurosis, may occur, although usually transient in character. Retinitis, however, may result in more or less permanent impairment of vision. Adler³ feels that optochin should not be recommended until further studies have demonstrated the possibility of giving it in smaller doses or until it is possible to eliminate from the drug the special constituent which acts on the visual apparatus. The amaurosis produced is a quinin amaurosis. With the latter drug, however, it develops only when large doses are given, whereas relatively small doses of optochin have sufficed to produce the condition. Adler reports 3 cases of amaurosis following the use of optochin. In 2 of them the condition was transient, but in the third

¹ Journal of Urology, April, 1917.

² Archives of Internal Medicine, April, 1917.

³ Therapeutische Monatshefte, September, 1916.

the impairment of vision persisted for several months and the vision was not completely normal nearly a year later.

That Adler's warning is not groundless can be gathered from isolated reports which are appearing from time to time. Schiotz¹ reports a case of transient blindness following the administration of optochin for pneumonia. Although vision was recovered it is still reduced, and, in addition, the man is color-blind, the visual field is much restricted, and the papilla grayish. A much more severe case is reported by Van der Hoeve and Mansholt.² In the case described by them a previously healthy young man with pneumonia was given optochin in moderate doses. He became totally blind, although vision partially returned later, but with paralysis of accommodation, atrophy of the optic disk, and sclerotic changes in the vessels. The impairment of vision was so severe that he was unable to resume his occupation. Van der Hoeve and Mansholt state that W. Hess, in 1915, found records of disturbance of vision in 6 per cent., and Uthoff, in 1916, in 3 or 4 per cent. It can thus be seen that the employment of this drug in pneumonia is not without danger.

Zentmayer³ has found optochin a valuable aid in the treatment of *pneumococcic infections of the eye*, stating that it often acts as a specific in pneumococcic ulcers of the cornea, providing the treatment is begun before active tissue destruction has occurred. Almost all the cases of this type manifested a shorter and more favorable course than did those treated in the earlier days by the well-recognized methods then in use. Aside from this type of infection, Zentmayer has no evidence at hand as to its value in diseases of the cornea and conjunctiva due to other organisms.

S. S. Cohen,⁴ and his co-workers, have contributed several studies on the effect of the various salts of *quinin*, including ethylhydrocuprein, on pneumococci. Among their observations it was shown that optochin possesses a real protective and curative value in experimental pneumococcus infections, although their results demonstrate a somewhat less marked antipneumococcus potency on the part of this drug than has been previously reported. In their opinion, ethylhydrocuprein stands today in a position somewhat similar to that of atoxyl in the treatment of experimental trypanosomiasis. The use of the drug in the treatment of pneumonia is, in their opinion, warranted. In another of their studies they incline to the belief that the good results of optochin and other cinchonics in pneumococcus infections is to be ascribed to their influence on phagocytosis.

Oxygen. The use of oxygen as a therapeutic agent is discussed by Haldane.⁵ He points out that in *poisoning by carbon monoxide* and similar respiratory poisons, death occurs when about 80 per cent. of the

¹ Norsk Magazin for Laegevidenskaben, June, 1917; Journal of the American Medical Association, August 11, 1917.

² Nederlandsch Tydschrift voor Geneeskunde, May 26, 1917; Journal of the American Medical Association, August 18, 1917.

³ New York Medical Journal, February 24, 1917.

⁴ Journal of Infectious Diseases, March, 1917.

⁵ British Medical Journal, February 10, 1917.

hemoglobin is disabled. If the patient is still alive there will, therefore, be 20 per cent. of his hemoglobin available. By administering pure oxygen one can at once increase the amount of oxygen in simple solution to about 2.5 c.c. This promptly averts any further danger from want of oxygen, and in carbonic oxide poisoning oxygen rapidly drives out carbon monoxide from the hemoglobin, so that after fifteen to twenty minutes of continuous administration the oxygen may be discontinued.

Oxygen is also of service in acute inflammatory conditions of the lungs. In cases in which the inflammatory condition is accompanied by the presence of edematous exudation throughout the lungs, cyanosis is often very great. This is due to the hindered passage of oxygen through the alveolar walls, and can be combated by raising the percentage of oxygen in the alveolar air and so increasing the diffusion pressure. This factor may be of decisive importance in acute lobar pneumonia. In heart cases in which cyanosis becomes marked the administration of oxygen may be of the greatest service.

Given continuously, Haldane states that the probable risks of prolonged administration of pure oxygen must be borne in mind, and, if necessary, balanced against the risks of allowing the oxygen-want to continue.

Paraffin Oil. In the treatment of *gastric ulcer*, Ferguson¹ feels that *mineral oil* is a most valuable acquisition to our list of remedies for this condition. It takes the edge of sharpness of the acid contents off the stomach, and, for a time, makes, in a mechanical sense, a coating and a protection for the ulcer. In this way it adds not only immediately but immeasurably to the patient's comfort. Because of this effect it is helpful to nature in its tendency to a cure. Paraffin oil is neither a drug, a poison, nor a food. It is nothing but a lubricant. To a lesser extent it inhibits the secretion of hydrochloric acid by coating the wall of the stomach. For this reason it is often helpful in cases of hyperacidity.

Pituitary Extract. The use of pituitary extract, usually in the form of pituitrin, has now become an established procedure in obstetric practice. From the very beginning of its use, experienced and thoughtful obstetricians foresaw its dangers and warned against its employment under certain conditions. The most serious of its dangers is *rupture of the uterus*, and, in spite of admonitions against using the drug in conditions likely to bring about this disaster, such accidents have occurred. McNeile² emphasizes the fact that the action of the drug is so powerful that it should be used with the greatest caution. It should be a fixed rule that pituitrin should never be used until there is complete dilatation and effacement of the os; that the membranes must be ruptured; that the presentation should be longitudinal; that in cephalic presentation there should be no deflection of the head; and that the drug be used only in vertex and breech presentations. Furthermore, it should never be employed in any case with an abnormally

¹ Virginia Medical Semi-Monthly, September 8, 1916.

² American Journal of Obstetrics, September, 1916.

narrowed pelvic outlet or in a case in which there is a disproportion between the presenting part and the pelvic outlet. The practice of employing pituitrin to hasten a normal labor cannot be too strongly condemned. Generally speaking, pituitrin cannot be administered as freely or as carelessly to primiparæ as to multiparæ, because of the anatomical differences. Its great field of usefulness, according to Mundell,¹ is in secondary inertia during the late stages of the second stage of labor in multiparæ. An ideal case for its use would be a healthy multipara with a history of previous normal labors, late in the second stage of labor, when the pains have become slow and weak, owing to uterine inertia, with a normal presentation and with the bag of waters ruptured, with the cervix fully dilated, and with the head molded and through the brim just above a relaxed perineum.

Mundell condemns the careless and indiscriminate use of pituitrin. In addition to the danger of rupture, of which I will speak presently, he attributes two additional dangers to the drug. Because of its powerful action and the precipitate character of the labor which it may produce, lacerations of the perineum are common, and there may occur also serious lacerations of the cervix. Some of the latter may extend well into the body of the uterus. Mundell also believes that pituitary extract is a potent factor in the production of *asphyxia* in the child. The explanation of the asphyxia is that in all probability it occurs late, probably in the last minutes of labor, when the placenta is about ready to separate from the uterus. The tumultuous and prolonged contraction with the shortened intervals constrict the placental site, limiting the amount of blood going to the placenta. The blood, therefore, is not probably oxygenated. There is also the possibility of a partial premature separation of the placenta, shown by the fact that in several cases the placenta is expelled immediately after the birth of the baby. Another factor which may enter is that during a violent contraction the cord may be constricted between the uterine wall and some part of the fetus, for instance, the sacrum, trochanter, or shoulder, resulting in asphyxia. Mundell admits that pituitrin has a distinct place in obstetric practice, but he also believes it to be limited, because of its undoubted bad effects on the child and to a lesser extent on the mother.

In reporting a case of *rupture of the uterus* following the use of pituitrin, McNeile² found references to 15 other cases in the literature. Mundell,³ in 1914, reported 3952 collected cases in which pituitary extract had been used, and for the year 1916 he added 1293 additional cases. The untoward results produced by pituitary extract is shown in the following table:

A COMPARISON OF STATISTICS OF 1914 AND 1916.

1914. Cases 3952.	1916. Cases 1293.
Ruptured uterus, 8 cases, or 1 rupture in every 494 cases.	Ruptured uterus, 12 cases, or 1 rupture in every 106 cases.
Fetal deaths, 27, or 1 fetal death in every 146 cases.	Fetal deaths, 34, or 1 fetal death in every 38 cases.
	Asphyxia pallida, 1 case in every 32.

¹ Journal of the American Medical Association, June 2, 1917.

² Loc. cit.

³ Loc. cit.

Two instances of rupture of the uterus are reported by Wertenbaker.¹ This report is of interest, as both cases were apparently of the type in which pituitrin is indicated. In neither was there any intra-uterine manipulation, attempted version, or use of the forceps. In neither case had true engagement taken place, but the presenting part was well within the pelvic brim, and otherwise met the usual indications for the use of pituitary solution. Both patients were multiparae; in both dilatation of the cervix was complete, the membranes ruptured, the fetus presenting by the vertex, with the uterine contractions weak and inefficient. The pelves were practically normal. Both cases were sent into the hospital because of the rupture, and, at operation, both babies were found above the normal size, one weighing a little over and one a little under 4500 grams ($9\frac{9}{10}$ pounds). The dose in each case was one ampoule (1 c.c.). These cases illustrate very clearly that even in cases in which pituitrin is apparently indicated it is capable of causing serious damage. In these cases an unduly large child was the contra-indication, which was not recognized. Another factor of even more importance is the size of the dose of the pituitrin. It is evident that in the cases reported by Wertenbaker that the drug produced contraction so violent that a tear resulted. Mundell² has pointed out that the contents of an ampoule (1 c.c.) is much too strong to be given in a single dose. It seems to be the better practice to give $\frac{1}{3}$ c.c. and repeat as needed, every thirty to fifty minutes. Given in this way the violent contractions of the larger dose are avoided, and, instead, the drug promotes and augments the normal rhythmic contractions of the uterus. Occasionally there are failures. According to Mundell these are to be ascribed to the facts that sometimes the contents of the ampoule are inert and also that sterilization of the syringe in alcohol is said to affect the action of pituitary extract.

The use of pituitary extract in *postabortion curettage* is advised by Bubis.³ It has the following advantages: (1) Preliminary packing of the cervix and vagina to induce softening of the cervix and stimulate uterine contractions is unnecessary. (2) No packing is placed in the cervix or vagina after emptying the uterus. (3) The injection of pituitrin is given after the cervix has been dilated while the patient is under an anesthetic. (4) Very little blood is lost while removing the placenta piecemeal. (5) The uterine cavity decreases in size as rapidly as its contents are removed. (6) Hot irrigations are unnecessary. (7) The operation takes only a few minutes. Rawls⁴ states that he has been accustomed to administer pituitrin immediately following curettement for *incomplete abortion*. He quotes Furniss as advising the injection of 1 c.c. of pituitrin fifteen minutes before the operation, claiming that there is less uterine surface to curette, less likelihood of perforation, and less danger of immediate and subsequent hemorrhage.

One of the most interesting facts that has developed out of the study

¹ Journal of the American Medical Association, June 2, 1917.

² Loc. cit.

³ American Journal of Obstetrics, 1916.

⁴ Virginia Medical Semi-Monthly, 1916.

of the pituitary gland is its effect on the secretion of urine. Mathews¹ has shown experimentally that extirpation of the posterior lobe, in dogs, often results in an enormous polyuria or *diabetes insipidus*.

Moltzfeldt² has also produced typical polyuria experimentally which he was able to check indefinitely with extracts of the pars intermedia and posterior lobe of the hypophysis, given orally, subcutaneously, or intravenously. Extract of the anterior lobe showed a similar effect, but only to a slight degree. Christie and Stewart³ noted that the blood flow in the hands seemed to be increased during the antidiuretic action of the posterior lobe extract. This, they believe, tends to support the view that a vascular effect in the opposite direction on the renal vessels may be responsible for the diminution in the urine secretion. It was also shown that under the action of posterior lobe extract, the kidneys had the power of effecting a considerable concentration of the urine.

As a result of the experimental studies on the effect of pituitary extract in polyuria the drug has been successfully used clinically. Motzfeldt⁴ has contributed a second article in support of the conclusion advanced by him that the pituitary body exerts its essential action upon the kidneys in the way of checking the flow and the urine, or, in other words, the function of the pituitary body in relation to the kidneys is that of an antidiuretic. By the use of the extract of the posterior lobe he has successfully treated a case of *diabetes insipidus*, and, in addition, has been able to control the urinary secretion in rabbits in which an artificial polyuria had been induced. At the last meeting of the Association of American Physicians, Barker and Mosenthal reported a case of diabetes insipidus successfully treated with pituitrin.

The use of pituitrin for the relief of *intestinal paralysis* is the subject of a paper by Colton.⁵ It is specially valuable in postoperative paralysis of intestinal movement and also the paralysis and distention often met with in certain of the acute diseases, notably lobar pneumonia and typhoid fever. Colton cites a case of pneumonia in which there was marked abdominal distention which was unrelieved by cathartics or enemata. Because of the marked fall in blood-pressure, 0.5 c.c. of pituitrin was given intravenously. He states that within thirty seconds the patient expelled large quantities of gas and an enormous stool, and that within three minutes the abdomen had returned to its normal size. Colton warns against the assumption that distention of the abdomen and failure of the bowels to move is always to be regarded as a postoperative paralysis. He cites a case in which pituitrin failed. The abdomen was reopened and it was disclosed that forty-two inches of the gut had become gangrenous. The possibility of the obstruction being mechanical must therefore be kept in mind, especially in postoperative cases. Rawls⁶ considers the drug the best intestinal stimulant we have. He orders it routinely in cases in which much handling of the abdominal viscera has been unavoidable. He also finds the drug inval-

¹ Physiological Chemistry, 1915.

² Journal of Experimental Medicine, 1917, xxv, 153.

³ Archives of Internal Medicine, July, 1917.

⁵ Buffalo Medical Journal, July, 1916.

⁴ Loc. cit.

⁶ Loc. cit.

nable in surgical cases complicated with *retention of urine*, not due to mechanical causes.

The effect of pituitary extract on the *blood-pressure* of febrile patients has been studied by Schmidt.¹ The pulse-rate, temperature, and respiratory rate were noted. Aside from an occasional slowing of the pulse-rate, which never exceeded ten beats per minute, no definite change in these occurred. Before the injection the pulse was usually bounding in character. Following the injection it was often smaller and more sustained. This was noted fifteen minutes later and persisted for an hour or more. No constant effect was noted in the systolic pressure, but the rise in the diastolic pressure amounted in some instances to 15 mm. of Hg. or more, and this, together with its time and relative constancy, made it certain that it was due to the action of the drug. The impression was also gained that the rise in the diastolic pressure was most striking and most constant when the pulse was definitely of the bounding or pointed form. No effect was noted in doses of less than 2 c.c., or when as much as 15 grains of the desiccated gland was given by mouth. The observations of Schmidt may explain the value of the drug in shock and in certain of the acute fevers, notably pneumonia. In the latter disease, pituitary extract has been highly recommended² as a means of stimulating a waning circulation by increasing the force of the heart, slowing the pulse-rate and raising the blood-pressure.

Pituitary extract has been recommended in the treatment of *asthma*. Miller³ states that inasmuch as pituitrin has an effect similar to adrenalin on the blood-pressure it has been advised in asthma. He calls attention to the fact that it has been shown by Pal, Pick, Baehr and others, that pituitrin produces bronchial spasm and that the relief given by adrenalin is due to its power to relieve this spasm. It has also been shown that when pituitrin and adrenalin are combined the action of the former on the bronchi is inhibited.

Stellwagon⁴ believes that pituitary extract (anterior lobe) is useful in the treatment of *impotence*. He first noticed its effect in this regard in a patient who was given the extract for another purpose. Later he tried it in other cases in some of which the results were remarkably good. The dose employed is 5 grains, by mouth, three times a day.

Quinin. Until the day comes when the extermination of the mosquito is complete, quinin must be our principal reliance both as a prophylactic and a curative agent in cases of *malaria*. It has long been recognized that in the pernicious and fulminant types of the disease, some method other than the oral must be used if the full effects of the drug are to be immediately exercised. Subcutaneous and intramuscular injections, especially the latter, are painful and often give rise to areas of local necrosis. Moreau⁵ has called attention to the number of severe abscesses and eschars developing after subcutaneous injections of qui-

¹ Archives of Internal Medicine, June, 1917.

² American Medicine, March, 1917.

³ American Journal of Medical Sciences, October, 1916.

⁴ New York Medical Journal, November 4, 1916.

⁵ Presse Médicale, March 15, 1917.

nin in the Macedonian campaign. Intramuscular injections he found to be less dangerous in this regard, although others have reported severe injuries to the sciatic nerve when the injections were made in the gluteal region.

Richet and Griffin¹ found that the intramuscular injection of quinin was painful, and often they saw cases admitted to the hospital with indurated lumps in the buttocks which later broke down into abscesses.

Braun,² from a large experience among African troops in 1915, states that ampoules containing 0.4 gram of quinin hydrochloride in 1 c.c. of excipient, being non-isotonic and caustic, are liable to cause an abscess at the site of the intramuscular injection.

Moreau advises that the intramuscular injection should be made three fingerbreadths outside of the posterosuperior spine of the ileum, on a level with the spine.

Where it is desired to obtain the maximum effect as early as possible the intravenous method is becoming more and more the one of choice. Richet and Griffin³ state that the cases of malaria that reached their hospital from Salonica were of a very severe type. Most of the men had been treated with numerous intramuscular injections of quinin, and all had been given the drug by mouth, but with no effect. The men were enemic, emaciated, exhausted, and suffered from rigors in which the temperature sometimes reached 107.8° F. Often they would pass into a state of coma in twenty-four hours. It was in these fulminant cases that the intravenous injection of *quinin urethane* was first tried. The solution was made up as follows:

Chlorhydrate of quinin	0.4 gm.
Urethane	0.2 gm.
Distilled water	1 c.c.

The injection was made with a fine needle mounted on an ordinary serum syringe of 15 c.c. capacity. To the quinin solution in the syringe was added 14 c.c. of physiological serum well warmed. The skin at the bend of the elbow was sterilized with tincture of iodine and alcohol and a bandage applied above the elbow to render the veins more prominent. When the needle enters the vein, blood will flow back into the syringe, and this will show that the solution is not being injected into the surrounding tissues. The bandage is then removed and the solution injected very slowly. Patients who are conscious will notice a bitter taste in the mouth, buzzing in the ears, and slight giddiness within a minute. In the coma cases the results were extraordinary. Consciousness was regained in five hours, and in from twelve to twenty-four hours the patient had recovered completely and all symptoms had disappeared. In some instances one injection was sufficient, and for weeks there was no further rise in temperature; in others a second injection was given within twelve hours if the return to consciousness appeared slow. Within twelve hours Richet found evidence of disinte-

¹ British Medical Journal, February 10, 1917.

² Editorial, Lancet, March 3, 1917.

³ British Medical Journal, February 10, 1917.

gration in the gametes and schizonts, and it was difficult to find any after forty-eight hours. Sometimes it was necessary to give two or three injections before the temperature remained normal and the gametes disappeared from the blood. In no case had the injection any ill effect; only one patient in a series of 70 cases had a slight thrombosis of a vein for a few days.

The conclusion arrived at by Richet and Griffin was that the intravenous injection of quinin urethane was the only treatment of malarial coma and a valuable remedy for persistent fever and chronic forms of malaria.

McLean¹ also endorses the intravenous method. In malaria and *blackwater fever* the use of quinin intravenously is the method of choice. It must be given, however, in concentrated solutions, that is 10 to 15 mls.,² and not in dilute solutions of 200 to 300 mls., otherwise alarming reactions will occur in debilitated patients. Under ordinary precautions and sterile technic, the concentrated solution is practically free from danger. The attack can be cut short and terminated and the patient saved much suffering and discomfort. In military service this means the saving of money, time, and the services of the men. Torrance and Bowman³ also recommend quinin in malarial hemoglobinuria. They employ rest in bed, calomel to be followed by a soapsuds enema and large quantities of water containing 30 grains of sodium bicarbonate to the pint, to prevent vomiting.

The *intravenous administration of quinin* is the subject of an excellent editorial⁴ article in which the experience of different observers is discussed. Baccelli employed the intravenous method with much success in cases of pernicious malaria, using a solution made up as follows:

Quinin hydrochloride	1.00 gm.
Sodium chloride	0.75 gm.
Distilled water	10.00 gm.

MacGilchrist, of the Indian Medical Service, believed this solution was open to two objections: (*a*) the fear of producing clotting in the vein, and (*b*) the danger of possibly producing hemoglobinuria. (As is well known, opinion varies considerably as to the effect of quinin in hemoglobinuria or blackwater fever. I have already alluded to McLean's experience with concentrated solutions of quinin in the treatment of this condition.) To avoid these objections, MacGilchrist advises a very dilute solution for intravenous use, namely, 7 grains of dihydrochloride of quinin in 2 or 3 pints of saline fluid. The editorial quotes the experience of Arellano, Maranda and Rablato at the San Juan de Dios Hospital in Granada, Nicaragua, who suggest that Baccelli was right and that concentrated solutions of quinin can be injected safely into a vein. (See also McLean's observations.) They believe also that the solution need not even be isotonic with the blood serum. Confronted with the

¹ U. S. Naval Medical Bulletin, April, 1917.

² The United States Bureau of Standards have adopted the term "mil" instead of c.c. as the latter represents a fraction more than a thousandth of a liter.

³ Ibid.

⁴ Lancet, March 3, 1916.

⁵ Loc. cit.

problem of dealing with many cases of serious pernicious malaria and being unable to obtain isotonic ampules, they used the acid non-isotonic solutions of the chloride, bichloride, and chlorhydrosulphate of quinin as supplied in ampoules by Parke, Davis & Co., Clin, of Paris, and others. These they diluted with an equal volume of warm sterile water. Their results were so good, and at the same time so sure, safe, and efficient, that they now employ it even in cases showing no signs of perniciousness. The patients merely complain of tinnitus, deafness, transient nausea, and a sense of heat spreading all over the body within one to ten minutes after the withdrawal of the needle. Children are also subjected to the treatment, in appropriate doses, when the veins are accessible. In them the results are specially good. The worst symptoms, in the pernicious form, such as amaurosis convulsions, algidity, and collapse, disappear in from three to six hours after the injections, though cases have occurred in which the patient was out of danger within an hour. Their results as reported are strikingly similar to those of Richet and Griffin.¹ Their technic is as follows: The solution in the ampoule is mixed within the syringe with an equal amount of sterile warm water. Care is taken to see that no precipitate or coagulum is formed as the blood comes in contact with the solution. At times it has been noted, especially when time is lost in inserting the needle, that a kind of flocculent precipitate is formed. Experience has shown that this is harmless.

Waters² states that *quinoidin* is an effective preparation both as a curative and prophylactic agent. It is not only effective but cheap. For the ordinary acute malaria as seen in out-patient work 12 to 16 grains daily are generally sufficient. Larger amounts may be given to the chronic and spleen cases. It is important that a preliminary purge be given.

Babcock,³ because of the necrosis produced by the injection of *quinin urea hydrochloride* in the vascular tissue, has used this combination in the treatment of *angiomias*. The technic is as follows: An ordinary syringe is employed, and for convenience a 33 per cent. solution of quinin and urea hydrochloride is prepared in ampoules containing 2 c.c. each. The affected area is infiltrated too widely. The chief action is to block the circulation and cause ischemia; therefore the entire area is infiltrated or a proximal infiltration is so given as to cut off the blood supply. In treating sensitive areas the preliminary injection of 0.5 per cent. novocaine solution may be used to prevent the initial pain.

A strong solution of the quinin urea hydrochloride injected into the skin produces an instant intense burning, quickly followed by analgesia. The area then becomes white, anemic, and necrotic. A few days later a shrunken, adherent black eschar marks the point of the injection. The surrounding edema disappears in a few days and the eschar slowly separates, with little evidence of inflammation or pain. If the urea is large a deep ulcer may be left which heals slowly.

¹ Loc. cit.

² Indian Medical Gazette, September, 1916.

³ New York Medical Journal, March 3, 1917.

The objections to the method are: (1) The primary transient but intense pain; (2) the marked secondary anemia; (3) the sluggishness of the residual ulcer; (4) the transient induration of the eschar; (5) the possibility of serious symptoms from quinin idiosyncrasy.

Babcock states that in port-wine stains or birth-marks or superficial angiomas the injection of a weak solution enables one to substitute a white scar for the objectionable color of the vascular growth. He also treated several cavernous angiomas successfully in this way. The injection may be employed also for the removal of warts and moles; a few drops of a 33 or 50 per cent. solution injected under the base of these growths is followed in a few days by rapid desiccation.

It is well known that many people have an *idiosyncrasy to quinin*. Boerner¹ has shown that such individuals will give a marked skin reaction if quinin sulphate, for instance, is locally applied after the method of von Pirquet. He suggests that this fact might be utilized to determine an idiosyncrasy to quinin in an individual to whom it was necessary to administer the drug.

Radium. The therapeutic use of radium, particularly in the treatment of warts, nevi, cervical erosions, etc., may now be considered to be one of the established procedures. Much remains to be learned, however, especially with reference to its exact mode of action, and more particularly its use in cancerous cases and the type of malignant tumor suitable for its use. An excellent review of the subject has been written by Ewing.² Of its mode of action, he states that little is definitely known. It is a reasonable assumption, however, that the gamma rays absorbed while traversing the tissues give rise to secondary beta rays, electrons, which act on the cells. That the action is electrical, accelerating cell ferments, ionizing gases, altering lipid emulsions, etc., may be further conceived, but is not demonstrated. Ewing states that it is important to note that the best effects of radium do not consist merely in the killing of cancer cells, but that it may excite a slow and complex process in which stimulation of capillaries and fibroblasts and exudation of lymphocytes are prominent, and even essential, factors in the healing process, while the tumor cells may be slow to yield their places. Surprising and satisfactory results may follow a single application. On the other hand, if repeated, strong applications have destroyed the bloodvessels and converted the base lesion into dense cicatricial tissue into which capillaries and leukocytes cannot penetrate. Groups of tumor cells may resist the direct action of radium and become the source of recurrence. Ewing believes that, under some circumstances, it appears that the reaction of the normal is a more essential curative factor than the direct action of the rays on tumor cells.

From the pathological stand-point Ewing states that the observed changes in cell morphology indicate an action directly on the tumor cell, and especially on its nuclear mechanism, with profound and progressive chemical changes in the nuclear proteins, attended by the

¹ Journal of the American Medical Association, March 24, 1917.

² Ibid., April 28, 1917.

formation of acid products and by the absorption of material, probably water. The appearance of the cell cytoplasm suggests hydrolytic cleavage of cell proteins, and these seem to excite leukocytic emigration. The growth of capillaries may be explained as a regenerative process following a loss of tissue equilibrium, or it may involve a direct stimulating action of the radium on endothelium and fibroblasts. In any event the process is very complex, and in many cases there are strong hints at a restoration of normal resistance of the connective tissue against lawlessly proliferating tumor cells.

Prime,¹ in a study of the effect of radium on tissue *in vita*, found that radium in sufficiently large doses will so injure the nucleus of the cell as to prevent further mitosis. This injury to the mitotic power of the cell does not, however, prevent a marked increase in the area of the culture due to an outwandering of the cell. The power of cells, thus crippled by the radium, to wander out from the main tissue is limited. When there is a marked outwandering of radiumized cells, but no mitosis, the tissue will not grow when inoculated into mice. Radium does not, therefore, kill the cells outright but injures the nucleus in such a manner as to prevent further division, which must eventually result in the death of the cell. Prime states that the stimulating effects of minimal doses of radium are shown by the profuse outwandering of the cells which occurs after sublethal exposures.

In order to overcome the outwandering cells which form an essential part of every cancerous growth, Nogier² advises the preoperative instead of the postoperative use of radium or the α -rays. He says he has been appalled at the histological findings of cancer cells scattered through the adjoining tissues after apparently complete excision of malignant growths. Particularly in the breast, improved technic has revealed cells sown through the tissue far back of the primary tumor. The operative interference arouses them, and, as a result, recurrences take place. The use of radium or the α -rays prior to the operation will give results which, in Nogier's opinion, will surpass anything hitherto obtained. As a result of the exposures, the scattered cancer cells lose all power of reproduction, and, if any embolism occurs during the operation, the embolus is sterile and metastasis does not occur.

In regard to the application of radium in the treatment of malignant disease, Ewing³ states that it is most essential to recognize that each case is a problem in itself, that very different types of cancer occur in the same organ, and that the successful application of radium as a strictly local agent requires accurate knowledge of the anatomy of cancer in general and of each patient's tumor in particular. Radium finds its greatest field for usefulness in the treatment of precancerous lesions, hypertrophies, atypical inflammatory overgrowths, warts and polyps of mucocutaneous junctions, numerous leukoplakias, cervical erosions, nevi and many accessible benign tumors. In these conditions it is efficient and comparatively free from danger, providing the treatment is entrusted to one experienced in its use. In regard to its use in oper-

¹ Journal of Cancer Research, April, 1917.

² Journal de Radiologie et d'Electrologie, March-April, 1917.

³ Loc. cit

able cancer, Ewing states that it remains for the future to decide. Radium is in its early stage of evolution and its use under these circumstances is for the expert to decide.

Frank¹ believes that because of the limited penetrating power of the rays and the variation of resistance of different cancers, it is probable that numerous disappointments will occur. Furthermore, he fears that in many cases positive harm will be done by enthusiasts who refuse to submit operable cancers to surgical interference.

In regard to its use in malignant disease of the uterus, Ewing² quotes the following recommendations of Doppert, an experienced worker in Petrograd: (1) Early localized cases, radium; (2) established or border-line cases, operation, because radium treatment is long and in such conditions uncertain; (3) inoperable cases, radium; and (4) advanced cases, neither radium nor operation.

In the treatment of border-line cases of cancer of the cervix, Frank³ advocates a short preliminary course of radiation. Mention has already been made of Nogier's⁴ observations on the presence of cells which have wandered into the tissues adjacent to the tumor and of the desirability of killing or crippling these cells by means of x-ray or radium exposures. Following the radiation, Frank, states that good primary results may then be expected from simple total hysterectomy. He also believes that these patients should be subjected to postoperative, prophylactic radiation, beginning not later than four weeks after the operation.

In the treatment of inoperable cases of cancer of the cervix, Frank states that in every case so far treated there has been a distinct amelioration of pain within two weeks after the second treatment. Coincidentally with the lessening of the pain, the bleeding diminished or disappeared, and the foul discharge became odorless and serous in character.

Extremely favorable results have been reported by Recasens⁵ in the treatment of *uterine cancer* by means of radium. He has used radium in 200 cases during the past three years. His experience indicates that the cancer cells are particularly sensitive to radium. He claims to have achieved a cure in all of the operable cases and in 70 per cent. of the inoperable. In the latter group, the interval has been over two years in 27 out of 47, and over one year in 45 out of 79.

Newcomet⁶ has reported 133 cases in which radium was used. Among the conditions treated, with more or less improvement, may be mentioned angiomas, moles, nevi, carcinoma (59), sarcoma (14), epithelioma (14) and a variety of other lesions. Newcomet concludes that an analysis of the wide variety of conditions treated, shows that in those to whom radium gave relief and comfort it could not have been accomplished by any other known means.

Ordway⁷ reports on the use of radium in cases of *chronic leukemia* resistant to röntgen-ray and benzol treatment. Under its use the blood picture becomes almost normal; the size of the spleen and lymph nodes

¹ Journal of Cancer Research, January, 1917.

² Loc. cit.

³ Loc. cit.

⁴ Loc. cit.

⁵ Archives Mens. d'Obstétrique et de Gynécologie, January, March, 1917.

⁶ Therapeutic Gazette, April, 1917.

⁷ Boston Medical and Surgical Journal, April, 1917.

are reduced almost to normal, and the general condition of the patient undergoes remarkable improvement. While he does not regard the radium as curative, he does believe it to be the safest as well as the most prompt, palliative measure available in cases of chronic leukemia, whether refractory or not to benzol or the *x*-rays.

In a study of the metabolism of a case of leukemia under radium treatment, Knudson and Erdos¹ found that the excretions of total nitrogen, urea, ammonia and phosphates are enormously increased immediately after the exposure to the radium. The uric acid output is only slightly increased compared to the other nitrogenous constituents.

In cases of *exophthalmic goitre* which prove refractory to the *x*-rays and other non-operative measures, Aiken² has found radium of service. This method of treatment was first employed by Abbe, and has since been successfully tried by others. Experimentally, it has been shown that the most constant changes in the gland after the application of radium are in the blood and lymph vessels. Clinically, Aiken's experience has been that the more penetrating radium rays diminish the vascularity and reduce the secretion of the thyroid gland.

Salicylates. Several interesting studies on the *action of the salicylates on the kidneys* have come from the pharmacological laboratory of the Western Reserve University, Cleveland.

Hanzlik and Karsner³ have shown experimentally that the administration of the salicylates to animals (cats, dogs, one rabbit), in doses corresponding to full therapeutic doses for human beings per kilo of body weight, causes the appearance in the urine of albumin, leukocytes, casts or cast-like bodies, and sometimes red blood cells. The albuminuria is of direct renal origin and preëxisting albuminuria is aggravated by the administration of salicylate. As far as the non-protein and urea nitrogen of the blood are concerned, there is a diminution in renal functional efficiency. Morphologically, a lesion of the kidney appears, varying in severity from simple cloudy swelling of the epithelium of the proximal convoluted tubules to extensive cloudy swelling of all the cortical parts of the tubules, associated with an acute intracapillary glomerulitis, the latter process being denominated as an acute tubular nephritis.

In a second study, Hanzlik, Scott and Thoburn⁴ have shown that the administration of salicylate in full therapeutic doses invariably causes the appearance of albumin, white blood cells and granular casts or cast-like bodies in the urines of normal, rheumatic, non-rheumatic, febrile and afebrile individuals. The *albuminuria* is not febrile in origin, but is due directly to the drug. So far as renal functional efficiency is concerned, there is a diminution. This is indicated by: (1) Lessened water excretion (taken in connection with 2 and 3); (2) diminished phenolsulphonephthalein excretion, and (3) accumulation of urea nitrogen of the blood. The administration of *sodium bicarbonate*, together with the salicylate, has practically no demonstrable influence

¹ Boston Medical and Surgical Journal, April, 1917.

² New York Medical Journal, July 8, 1916.

³ Archives of Internal Medicine, 1917, xix, 106.

⁴ Ibid.

on the albuminuria and renal functional changes produced by the salicylates.

In the third paper on the action of the salicylates in the production of albuminuria, Scott and Hanzlik¹ reach conclusions similar to those already given. In this paper they state that, quantitatively, albuminuria reaches its maximum at "toxicity" (ringing and deafness in ears, vomiting, etc.); then gradually diminishes and eventually disappears, a trace of albumin persisting in those individuals who showed a trace of albumin before the administration of the salicylate. Sollmann,² in discussing this paper, states that the work of Hanzlik and his co-workers settle the dispute of the occurrence of albuminuria after the administration of the salicylates. There is no doubt that the doses of salicylates used therapeutically do produce albuminuria. Whether that has any significance or not is yet to be decided and will require further work. While the occurrence of albumin should make one cautious with the administration of the salicylates where renal changes are known to exist, Sollmann states that it does not appear that permanent damage is done with the doses ordinarily employed. So far as known, these patients recover perfectly, the albumin disappears and leaves no change behind.

In a fourth study on the action of the salicylates on the blood and joint fluid of individuals receiving full therapeutic doses of the drug Scott, Thoburn and Hanzlik³ reached the following conclusions:

1. The percentage concentration of salicylate in the blood and joint fluid of rheumatic individuals receiving full therapeutic doses of the drug is approximately the same.

2. The concentration of salicylate tends to be less in the blood of rheumatic than non-rheumatic individuals.

3. There is no demonstrable free salicylic acid in the joint fluid of individuals suffering with rheumatic fever.

4. The true reaction and the reserve alkalinity of the blood are not perceptibly altered by the administration of salicylate even in large doses.

In the study of the TOXIC EFFECTS OF SALICYLIC ACID, Bartholow and McNeil⁴ examined the natural and commercial acids and their sodium salts and made some clinical studies of the following substances, described as complementary: cinnamate of sodium, phthalic acid, saligenin, salicin, methyl salicylate. In the case of the natural acid, when administered to adults there was less gastric disturbance, the cerebral effects were less marked, and in general it may be said that this substance is better borne than the commercial acid. It is not toxic in very large doses, though when more than 75 grains are given in twenty-four hours there is a tendency to delirium in the susceptible and to salivation and flushing of the integument. The ringing in the ears is noticed on the second day, as a rule. In the opinion of Bartholow and McNeil, it seems clear that the natural acid has less cumulative effect.

¹ Journal of the American Medical Association, December 16, 1916.

² Ibid.

³ Journal of Pharmacology and Experimental Therapeutics, January, 1917.

⁴ American Journal of Medical Sciences, May, 1917.

In the TREATMENT OF ACUTE RHEUMATIC FEVER, da Matta¹ claims to have obtained good results by giving sodium salicylate and sodium iodide *intravenously*. He injects, by means of a fine needle, 100 c.c. of a 5 or 10 per cent. solution of sodium salicylate. He then injects, through the same needle, 20 to 30 c.c. of normal salt solution and follows this with 50 to 100 c.c. of a 10 per cent. solution of sodium iodide. He claims to have had no untoward effects. In this connection the reader is referred to the Section on "Intravenous Medication."

Serums. ANTIDIPHTHERITIC SERUM. In an extremely interesting review of the question of the susceptibility of man to foreign proteins, Longcope² states that it would be the greatest mistake and misfortune at the present time if *anaphylaxis* is allowed to have any bearing on the use of antitoxic and antibacterial sera. The concentrated diphtheria antitoxin, such as is now employed, rarely produces serum disease or sensitizes sufficiently highly to make a second dose, particularly if it is given subcutaneously, in the least dangerous, and it is only to the spontaneously sensitive who react to the first injection that harm is likely to come. To prevent accidents in such unexpected instances, especially if large quantities of serum are given intravenously, a preliminary intracutaneous injection of 0.01 to 0.1 c.c. of serum should be made to determine whether or not the patient is spontaneously sensitive to the serum which is to be employed.

ANTIDYSENTERIC SERUM. In regard to the use of multivalent anti-dysenteric serum, Fisher³ states that no hard-and-fast rule can be laid down as to the quantity necessary to inject. Each individual case must be judged upon its merits, with the proviso that cases coming under treatment late in the disease require larger doses than those of equal or greater severity seen at the onset. In the severe cases, Fisher injected 80 c.c. into the flank within a few hours of their admission; the milder cases were usually given 40 to 60 c.c. the following morning. Some of the mild cases do not require serum, but Fisher has noted that a severe case treated with serum immediately after admission often recovered more rapidly than a mild one treated without it.

One large dose of serum is sufficient to cure some cases; others, though much improved, require more, and in these patients, after waiting forty-eight hours, an additional dose of 60 to 80 c.c. are given. Some of the worst cases may require a third or even a fourth dose of the serum. Some fulminating cases have been given as much as 140 to 160 c.c. of the serum in the first twenty-four hours. In these patients the first doses should, if possible, be given intravenously, for every moment saved is of vital importance.

In the majority of patients the serum acts like magic, although there are a few in whom it seems to have but a slight beneficial effect. If four doses of 80 c.c. each, spread over a period of six or seven days, have not brought about the desired result, Fisher does not think further injec-

¹ Brazil-Medico, October 14, 1916; Journal of the American Medical Association, December 23, 1916.

² American Journal of Medical Sciences, November, 1916.

³ British Medical Journal, January 13, 1917.

tions are indicated. He has never given more than 320 c.c. to any one patient.

In most of the cases there is a distinct rise of temperature within twelve hours after the injection of the serum, and in some instances this may last from forty-eight to seventy-two hours. This rise in the temperature Fisher regards as a good prognostic sign, for in all cases in which it was marked the patients recovered rapidly. It is because of this reaction, which may be quite severe, that he allows forty-eight hours to elapse between the injections.

Evidences of serum disease were most frequent on the seventh and eighth days after the initial injection. The severity of the reaction varied with the particular stock of serum in use. Symptoms of serum disease occurred in 70 per cent. of the cases in which serum was used. The symptoms consisted of a rise in the temperature in all cases, and, in addition, there may be urticarial rashes, headache, sore throat, joint pains and edema of the scrotum.

In all, Fisher has treated 456 cases. Among a large number of the early cases, the pressure of work did not permit of making careful notes. Of 296 cases seen later, 183 were examples of acute bacillary disease and the remaining 113 were either chronic amebic or bacillary dysentery.

In addition to the use of the serum Fisher gives a greatly restricted diet, stimulants for the fulminant cases, and the use of 1 dram of magnesium sulphate three times a day in order to wash out the bowel.

Sedative mixtures, while apparently demanded in order to diminish pain and permit sleep, he does not approve of. He found that the effect on the pain was transitory. Furthermore, he found that the effect on the diarrhea was only temporary and that in a few days it became as bad as ever. In very bad cases morphin is used, and, if the tenesmus is severe, a suppository consisting of cocain $\frac{1}{2}$ grain, and iodoform, 3 grains, will be found useful.

ANTIPNEUMOCOCCIC SERUM. The use of serum in the treatment of pneumonia may be said to have passed the experimental stage for at least one type of the disease, namely, that caused by the pneumococcus known as Type I. The introduction of serum in the treatment of lobar pneumonia is not only the greatest therapeutic advance made in combating this disease, but in addition, the use of the serum has been invaluable in determining the type of organism in each case. It has been found that the serum of pneumonia patients or animals suitably immunized against pneumococci will agglutinate organisms belonging only to its homologous group.

It is apparent, therefore, that the type of organism concerned in the causation of an attack of lobar pneumonia must be of primary importance from the stand-point of specific therapy, whether it is curative or prophylactic.¹ The most encouraging results obtained so far have been with the Type I infection. A serum has also been prepared for the Type II infection, but this is of markedly less potency.

¹ Editorial, Journal of the American Medical Association, May 12, 1917.

Based on figures prepared from a study of the types of organisms in 400 cases, Cole¹ has illustrated the mortality in the following table:

IN EVERY 100 CASES OF LOBAR PNEUMONIA:

35 are due to pneumococci of Type I.	Of these, 10 die.
30 are due to pneumococci of Type II.	Of these, 10 die.
10 are due to pneumococci of Type III.	Of these, 6 die.
25 are due to pneumococci of Type IV.	Of these, 4 die.
<hr/>	
100 are due to pneumococci of all types.	Of these, 30 die.

It will be seen that the cases due to Type I and II make up over 60 per cent. of the cases and show the average mortality. In different years and in different places, the mortality may vary. The mortality for Type I is by far the most constant—25 to 30 per cent. In the others it may vary as shown in the cases at the Presbyterian Hospital, New York. In this Hospital, Bovaird² states that in 1914 the mortality for group IV was 5 per cent.; in 1916 it was 25 per cent.

As already stated the results obtained in infections due to Type I are most encouraging, although the number treated is not large. Up to the present time, Cole³ has treated 105 cases at the Rockefeller Hospital, and, of these, 97 have recovered and 8 have died. Of the 8 fatal cases, 3 were treated only a few hours before death, late in the disease; one patient died on the sixteenth day of pulmonary embolism; one died on the fifty-fourth day with a general streptococcus infection, following empyema; one at necropsy was found to have tuberculosis involving both lungs, with only a small area of pneumonia involving a part of one lobe. This leaves but 2 cases in which treatment may be said to have been at all adequately carried out, or in which specific treatment could be expected to be of any value, and these were treated late in the disease. The significance of these figures is made more striking from the following statistics given by Cole.⁴ In 1914, the number of deaths from lobar pneumonia alone (not including broncho-pneumonia) in New York City was 5145; in 1915, 6086; and in 1916 will probably be greater still, for in the month of January over 1100 deaths from lobar pneumonia occurred. Of the deaths in 1914, probably 1800 were due to pneumococcus Type I.

The serum for Type I is obtained by immunizing horses and is extremely potent. Thus, 0.2 c.c. of such a serum will protect a mouse against as much as 0.1 c.c., or, in some cases, 0.4 to 0.5 c.c. of a culture, of which 0.000001 c.c. when given alone, without the serum, will certainly kill. A serum has also been obtained for Type II but this is of little value.

Recently, Wadsworth and Kirkbride⁵ have been able to immunize a horse with Type III (*Pneumococcus mucosus*), the most virulent of all the pneumococci. Although this serum has but a slight degree of

¹ Pennsylvania State Medical Journal, February, 1917.

² Journal of the American Medical Association, August 18, 1917, p. 509.

³ Ibid.

⁴ Pennsylvania State Medical Journal, February, 1917.

⁵ Journal of Experimental Medicine, May, 1917.

potency, it has proved of distinct value as an aid in the differentiation of pneumococcus strains. Previously it had been necessary, in order to obtain complete agglutination with fresh, untreated, homologous organisms, to remove the capsule of Type III.

In regard to the use of the serum in cases of infection due to Type I, Cole states that the serum should be administered as soon as the type of organism has been determined. In his opinion it is not fair to the treatment or to the patient to wait to see whether the case is going to be severe or not. All experienced physicians know that nothing is more difficult than prognosis in pneumonia. With the laboratory aids available, it is not infrequently possible to say, even in the absence of severe symptoms, that a case will progress badly, but it is next to impossible to say with any authority, early in the disease, that a patient will recover. All patients with Type I infection should therefore be treated with serum, and treated as soon as the diagnosis is made.

In order to determine whether the patient is sensitive to a foreign protein, Cole proceeds as follows: A small amount of a foreign protein, such as horse serum (0.5 to 1 c.c.) is injected into the patient's skin, not subcutaneously. If the patient is sensitive, within an hour there will occur a characteristic local edema and erythema, which is entirely lacking at the site of injection in patients who are not sensitive. It is therefore important that this test should be made before giving the anti-pneumococcic serum, and this applies to all forms of serum therapy. Even if the patient is sensitive to the serum, it has been shown that this can be overcome and the patient completely desensitized so that huge doses of serum may be given. This is done by making the injection very gradually, beginning with an extremely minute dose, and following this with doses of gradually increasing size. In the case of a patient who is sensitive, Cole allows at least fifteen minutes for the injection of the first 15 c.c. If no reaction has occurred, the remainder may be injected more rapidly, and subsequent doses may be injected without this delay. If the skin test has shown the patient to be sensitive, additional measures to desensitize the patient should be taken in the way of repeated injections, beginning with small doses and gradually increasing them. One should always be cautious in a patient subject to asthma, hay fever, or other forms of protein sensitiveness.

In the administration of the serum, Cole gives the following deductions:

"The serum should be given intravenously, preferably diluted once with freshly prepared sterile salt solution, though this dilution is not absolutely necessary, provided the serum be injected slowly enough. The dosage is at present empirical. For reasons into which I cannot enter here, however, we believe that the dose for an adult should be at least 75 to 100 c.c., and, if necessary, this should be repeated every six to eight hours until a favorable result is obtained. In most cases two or three doses are sufficient. The average amount employed in our cases during the past winter, if we except the one fatal case which was treated over a period of five days, has been 250 c.c. Usually within an hour or two following the injection, there occurs a slight elevation of temperature succeeded by a marked fall. Frequently, however, the

temperature does not remain low, but, after a period of from eight to twenty-four hours, it again begins to rise. We feel that it is extremely important to watch the patient after the administration of serum, taking the temperature every two hours, and whenever this rise occurs the administration of serum should be repeated at once. If no change occurs following the first dose, the reinjection should always be made within six to eight hours. Experimental evidence, as well as clinical observations, indicate that we should persevere, even if no reaction is obtained after several doses."

In addition to the evidences of sensitiveness already mentioned, Cole states that there is a second form more difficult to guard against. They may appear during the administration of the serum, or may be delayed for an hour or more. The symptoms are similar to those seen in anaphylactic shock, consisting of restlessness, tachycardia, suffusion of the face, sweating and occasionally vomiting. High elevation of temperature, with abrupt fall, may be a part of this non-specific serum intoxication. The same kind of reaction sometimes occurs after the injection of salvarsan or large doses of vaccines. Certain lots of serum are more prone to cause reactions than others; these, Cole states, should be discarded. He states that the danger of these reactions can, to a certain extent, be minimized. The injection should be made slowly, and the serum should be heated to the body temperature before injection. If the patient shows signs of distress during the treatment, the injection should be stopped, and continued an hour or two later. If such reactions occur, the injection of 0.5 c.c. of epinephrin solution, or 0.01 grain of atropin will usually give relief. Although these reactions appear alarming, Cole states that he has never seen that they affected the course of the disease or interfered with the efficiency of the serum.

Finally there is to be considered the symptom-complex, known as *serum sickness*, familiar to all. Serum sickness is most apt to appear about fourteen days after the administration of the serum. While at times distressing, it is never serious and leaves no sequelæ. Cole has emphasized the necessity of becoming familiar with the symptoms which may occur during or after the administration of the serum, as it has been claimed by some that the danger of anaphylaxis is so great, and the discomfort of the reactions so marked, that serum therapy in pneumonia should not be employed. This point of view he believes to be entirely wrong and not in accordance with the facts.

ANTIPOLIOMYELITIC SERUM. Human serum obtained from individuals who have recovered or are convalescent from acute poliomyelitis has been employed in the treatment of those acutely ill from the disease. At present this seems to be the only form of anything like a specific treatment at hand. It should be used early in the course of the disease, and freely whenever possible. Of the cases so far treated in this way, the testimony is distinctly favorable to its use.

Amoss and Chesney¹ have reported 26 cases so treated. Of 12 cases which showed paralysis at the time serum was first given, 1 patient died

¹ Journal of Experimental Medicine, April, 1917.

ten hours after the serum was given, 2 patients suffered small degree of extension of paralysis, while the remaining 9 showed no increase in the paralysis. Of 14 cases in which no paralysis was detected at the time the serum was administered, 2 patients developed respiratory paralysis and died; and 2 others developed some degree of weakness or partial paralysis of certain muscle groups. The 10 remaining cases never showed any demonstrable weakness. In the last mentioned cases, the fever, sometimes high, tended to fall rapidly to normal, the average time of the fall being 25.7 hours.

In the experience of Amoss and Chesney, the intraspinal injection of the serum was harmless. The earlier the serum is given in the course of the disease, the greater is the promise of benefit. In the cases they report, and especially in the group in which no paralysis existed at the time of the first injection, the process either did not progress at all, or, where there was extension, as in 2 cases, the upper segment of the spinal cord became rapidly involved and was followed by respiratory paralysis and death. They believe that in those cases in which some degree of muscular weakness develops soon after the injection of serum, reinjection twelve to twenty-four hours later may be advantageous.

Wells¹ advocates the injection of the human serum intravenously or intramuscularly rather than intraspinally. The great advantage of the intravenous route is that it permits the giving of a practically unlimited amount of serum and thus allows of the introduction of a much greater quantity of the specific antibodies than is possible by the intraspinal method. In addition, it may be desirable to replace some of the spinal fluid with serum. In this way the disease is attacked from all sides.

Rueck² has treated poliomyelitis by means of the transfusion of citrated normal blood of adults. He believes that most healthy adults and children are immune to acute poliomyelitis and that the blood of most people must contain antibodies, or at least be able to produce antibodies rapidly when the virus tries to invade the body.

Efforts have been made, and are being made, to produce a horse serum which will have protective and curative properties against the virus of acute poliomyelitis. So far there has been no great success. Neustaedter and Banzhof³ have issued a preliminary report in which they state that they were able to produce a horse serum which neutralized the virus in monkeys. Although their experiments were limited, they feel justified in using the serum in human cases, especially when human serum is unobtainable.

ANTIRABIC SERUM. Mejio⁴ states that out of a total of 19,800 persons treated at the Pasteur Institute at Buenos Aires, only 93 (4.76 per thousand) succumbed to rabies. Twenty-four developed paralytic accidents, and in 4 the consequences were fatal. Six years ago he reported 10

¹ Journal of the American Medical Association, October 21, 1916.

² Medical Record, September 30, 1916.

³ Journal of the American Medical Association, May 26, 1917.

⁴ *Semana médica*, Buenos Aires, xxiv, No. 1; Journal of the American Medical Association, May 12, 1917.

cases of paralytic accidents consecutive to the Pasteur treatment and in each the symptoms suggested acute transverse myelitis in the dorso-lumbar region. In the series now reported the disturbances were of the nature of peripheral neuritis, polyneuritis, or acute ascending paralysis. Mejo believes these accidents can be minimized by greater care in the preparation of the virus and of the patient. He warns that any effort to shorten the course of treatment may be disastrous. In 7, of 11 cases, the paralytic phenomena were restricted to a limited region and soon subsided more or less completely. The region affected was exposed to the air and thus subject to chilling.

ANTITETANIC SERUM. Even prior to the war tetanus antitoxin had established its place as an efficient prophylactic. The experience gained during the war has only served to emphasize this opinion. The use of this agent in armies is at present extensive. McCoy¹ states that it is understood that single orders for as many as 500,000 doses have been placed in America by European governments, and, in addition, enormous quantities are being manufactured in Europe. It has been the rule to give every wounded soldier a prophylactic dose of tetanus antitoxin as soon as possible after the wound is inflicted. During the early part of the war, the dose used was 1500 American units. In the English service this has been reduced to 500 units repeated every seven days until the wound has healed or become healthy.

Dean² points out that one result of prophylactic injections is to prolong enormously the incubation period, with the result that tetanus may occur after the wounds have completely healed, and the patient has been transferred to a convalescent hospital. In order to overcome this, it has been found necessary to repeat the dose. Dean emphasizes the danger of compound fractures and the need of immunizing doses when such wounds occur. Of 25 cases of tetanus treated by him, 11 suffered from a compound fracture.

In a series of 160 cases of tetanus studied by Leishman and Smallman³ the average incubation period was something over twelve days. Of the fatal cases, 115 in number the average incubation period was 10.7 days, and of the 42 recoveries it was fourteen days. The shortest period of incubation was two days, and the longest ninety days. It is worthy of note that the latter, and one other with an incubation period of fifty-two days, died. Recognizing that the earlier the preventive dose is given after the receipt of the wound, the more likely is it to be of use—Leishman and Smallman made an effort to obtain precise details as to the number of hours which had elapsed between the infliction of the wound and the use of antitoxin. This was done in 66 out of 160 cases. Of the 43 cases which received, within twenty-four hours, a preventive dose of 500 or more units—less is never given—62.7 per cent. were fatal and 37.2 recovered. Of 23 cases in which the giving of the antitoxin was, for one reason or another, delayed beyond twenty-four hours, 86.9 per cent. died and only 13 per cent. recovered. It was shown in this comparatively small number of cases that the incubation period was

¹ Journal of the American Medical Association, May 12, 1917.

² Lancet, May 5, 1917.

³ Ibid., January 27, 1917.

increased by a prophylactic dose in those who recovered, even when the dose was delayed.

MacConkey and Homer¹ have made some experimental observations in order to ascertain the smallest quantity of antitoxin which would give complete protection for one week. They found that in the guinea-pig $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ U. S. A. unit does not afford complete protection for one week, though these amounts saved life against a dose of toxin which was fatal to the controls. One unit, or more, however, gives complete immunity during at least one week. As an ordinary man is about 220 times heavier than a guinea-pig, this would mean that a man would require some 250 U. S. A. units to protect him for a week, while a dose of 500 U. S. A. units would allow for a man being twice as susceptible as the guinea-pig.

In regard to the *treatment of fully developed tetanus* by means of *antitoxin*, the results never have and do not now approach the prophylactic success. The dosage seems the most difficult matter to judge. Recovery has followed a dose ridiculously small, and others have died in spite of enormous doses. It is essential to use the serum at the earliest possible moment. If given subcutaneously and intramuscularly, not less than 10,000 units should be administered daily.

Another disputed point is the route by which the serum shall be introduced—intraspinally, intravenously, intramuscularly, subcutaneously or whether two or more of these methods be employed at once.

As a curative agent, McCoy² advises, in the presence of clinical tetanus, 3000 units of the serum intraspinally at the appearance of the first symptoms; 10,000 units in addition should be given intravenously. The spinal dose should be repeated daily until improvement sets in, and the blood should be kept antitoxic by further subcutaneous doses of 10,000 units.

Dean³ believes that the intravenous route is to be preferred because of the large dose which can be given. In 4 cases serum treatment was confined to a single intravenous dose of 30,000 units. In 3 others no serum was given subsequent to the intravenous injection. In these 7 cases recovery was as rapid as in 6 other cases in which subsequent injections were given. In patients receiving an intravenous injection of 30,000 units, their serum was shown to contain free antitoxin at various intervals up to thirty-nine days. Leishman and Smallman,⁴ on the other hand, condemn the intravenous route, as it introduces the possible element of anaphylactic shock and has done little, if any, good. They are also opposed to the intrathecal route. They favor the subcutaneous and intramuscular routes. Merle⁵ cites 37 cases, reported by various writers, of recovery from tetanus under intraspinal injections of large doses of antitetanus serum.

Gibson⁶ advises the use of tetanus antitoxin immediately on the suspicion of tetanus developing, rather than waiting for classical symptoms. He recommends that the serum be injected into the wound or region of the wound (1500 units); intraspinally (5000 to 20,000 units)

¹ Lancet, February 17, 1917.

² Loc. cit.

³ Loc. cit.

⁴ Loc. cit.

⁵ Paris Médical, December 16, 1916.

⁶ American Journal of Medical Sciences, December, 1916.

without an anesthetic, unless the treatment of the wound calls for a general anesthetic.

In the first twenty-four hours, in addition to the above, 10,000 to 20,000 units should be administered intravenously in divided doses, say two or three. Antitoxin intravenously (5000 to 15,000 units) should be given the next day no matter whether the symptoms remit or increase. On the third day if, notwithstanding the treatment already given, the symptoms continue severe or grow worse, the intraspinal treatment should be repeated. If all goes well, the intraspinal treatment need not be repeated, but the daily intravenous injection should be given until obvious remission or a cure results. One of his cases received a total of 169,000 units, 29,000 of these being given intraspinally in six sessions. Gibson is convinced, although his series of cases is small and several of them of the severest type, that the intraspinal method gave him complete control of the situation. For this reason he hesitates to recommend any other method of treatment until a superior one is found.

Richardson¹ has reported a case of tetanus in which recovery followed the use of large doses of antitoxin. In all, 152,500 units were given; 45,000 units in nine doses, subcutaneously; 56,500 units in nine doses, intraspinally; and 51,000 units in eight doses, intravenously. He attributes the successful outcome of the case to the fact that the combined routes were used. His case is of additional interest by reason of the fact that a secondary *multiple neuritis* developed. In a study of the literature this was found to be a very rare sequel.

Organic Silver Preparations. Olson² has directed attention to a pronounced bluish-green, slate-gray, or dark brown permanent *pigmentation of the skin* which may occur as the result of the local use of *argyrol* or others of the organic silver preparations. He summarizes his observations as follows:

1. A very unsightly, permanent pigmentation of the skin may follow the local use of argyrol and the various other organic silver preparations.

2. The use of freshly prepared solutions of argyrol does not diminish in any degree the danger of argyria.

3. The bluish-green or slate-gray color is not due to a bluish-green or slate-gray color of the silver deposits, but to the fact that the dark brown silver deposits appear bluish green or slate gray when seen through the uninvolved translucent epidermis.

4. The occurrence of localized argyria following the use of argyrol, protargol, etc., is uncommon, but the resulting blemish is so unsightly that every care should be taken in the use of these substances. The solutions should never be forcibly injected into any cavity or canal as the tear ducts, urethra, etc., and should not be applied when the skin or mucous membrane is not intact.

5. The general opinion is that the condition is irremediable. The conclusions drawn from this paper warrant a more hopeful prognosis.

¹ Journal of the American Medical Association, June 2, 1917.

² Ibid., July 14, 1917.

6. Local measures, such as blistering and electrolysis, are possibly of some value in causing an inflammatory reaction that favors absorption of the silver deposits.

7. The hexamethylenamin treatment should be given a trial in every case of argyria due to organic silver compounds.

SILVER NITRATE. In the treatment of *ulcerative stomatitis* and *Vincent's angina*, Ramond¹ recommends the following treatment: The patient first gargles with a 1 per cent. solution of cocain. In five minutes the ulcerated cavity can be cleaned out with a blunt curette or a hard brush. If there is slight hemorrhage, this can be arrested by having the patient gargle with a solution of hydrogen dioxide. The cavity of the ulcer is then dried with cotton and touched with a tampon moistened with a 1 to 50 solution of *silver nitrate*. This procedure should be repeated daily for several days.

Syme² has treated 8 cases of *asthma* by the direct application of silver nitrate (10 per cent.) with the aid of the bronchoscope. The main bronchi and entrances of the secondary bronchi are so treated. A mixture of cocain and epinephrin is applied in advance of the tube. This mixture might be applicable in cases of bronchiectasis.

Sodium Cacodylate. Claims have been made that this drug is an efficient remedy in *syphilis*. H. N. Cole,³ after an experience with the drug, was able to confirm the contention of Nichols and others that it is worthless as a spirocheticide. At the utmost it has perhaps a slight action on the papular and nodular syphilids, but in no case is it to be compared with even mercury and iodide alone. In cases of syphilis with mucous patches, it is worse than useless. In no instance was a positive blood Wassermann reaction changed to a negative one by its use. As many physicians are using sodium cacodylate in the treatment of syphilis, and as there is, in addition, a widely advertised preparation on the market called *venarsen*, which has as its main constituent sodium cacodylate, Cole warns against their use.

Sodium Succinate. In a study of the effect of the subcutaneous administration of this drug, Hammett and Kessler⁴ found that, in doses of 0.1 c.c. of a 1 per cent. solution, there was an increase in the leukocyte content of the blood of both normal and pathological persons.

In an investigation of the action of sodium succinate, Salant and Schwartze⁵ found that strong and medium concentrations of the drug generally caused stimulation of the intestines, the effect on the small intestines being the more marked.

Strophanthin. Hay⁶ states that the onset of cardiac failure, especially when associated with auricular fibrillation, is sometimes so sudden, and the downward progress so rapid, that oral medication may prove too slow to be of any service. Furthermore, the patient's stomach may not tolerate any of the digitalis group. In such cases, strophanthin

¹ Progres Médical, December 20, 1916.

² British Medical Journal, June 30, 1917.

³ Journal of the American Medical Association, December 30, 1916.

⁴ Ibid., July 17, 1917.

⁵ Journal of Pharmacology and Experimental Therapeutics, June, 1917.

⁶ Liverpool Medico-Chirurgical Journal, 1916.

injected into a vein produces immediate slowing of the heart and a rapid amelioration of the patient's condition. Hay believes this procedure has saved many lives.

Theocin. In a study of the *diuretic effects of theocin*, Christian¹ found that in patients with *acute nephritis* or *chronic nephritis* or *cardiorenal disease* with slight or no edema the drug has little or no therapeutic value, inasmuch as diuresis is not constantly produced. Furthermore, the elimination of nitrogenous substances quite often is slightly, if at all, increased, and renal function is frequently decreased after giving theocin.

In cardiorenal cases with marked edema, theocin is of therapeutic value, because it produces, especially in conjunction with digitalis, an active diuresis with increased sodium chloride elimination, which decreases edema, a troublesome feature in these cases. As there is evidence that, following diuresis, renal function is depressed, Christian advises an intermittent usage of theocin rather than its continual administration in cardiorenal cases with edema.

Tobacco. To what extent the use of tobacco is harmful is problematical; that is, the moderate use of tobacco. Physicians themselves hold very divergent views on the subject. There can be no doubt that the use of tobacco is often prohibited on general principles, and with no very definite idea as to whether its use is contributing to the patients' ill health or not. One is probably safe in saying that its use is advised against quite as often unnecessarily as the reverse. Thompson and Sheldon² have made some interesting observations on the *effect of tobacco on the blood-pressure*. Summing up their conclusions, it would appear that when a man has a constantly high blood-pressure the use of tobacco is inadvisable. So far as its use by healthy individuals is concerned it is questionable whether it can be considered harmful if used moderately. And in interpreting the term "moderate," the strength of the tobacco, the constancy of its employment and the susceptibility are to be considered in each instance.

Trional. A case of chronic *poisoning* with this drug is reported by von Noorden.³ The patient was a woman, aged sixty-eight years, who for twenty years had been taking from 10 to 15 grains of trional about twenty times a month on retiring. She finally developed the following condition: weak heart action, malaise, weakness, anemia, and polyneuritis. She ascribes the absence of skin disturbances to the fact that she kept indoors and was thus shielded from the sunlight. Usually in cases of this kind they present methemoglobinuria and nephritis which this indoors-keeping woman escaped, although the urine was cherry-red for a time.

Thymol. The use of this drug in the treatment of *trichinosis* is reported by Booth, Goehring, and Kahn.⁴ They divide the treatment of trichinosis into two stages: (a) The period when the parasite is

¹ Archives of Internal Medicine, November, 1916.

² New York State Journal of Medicine, 1917.

³ Therapeutic Monatshefte, September, 1916.

⁴ Journal of the American Medical Association, December 30, 1916.

within the lumen of the intestine, and (b) the period when it is within the muscles and tissues of the body. In the first period the drug is used as an anthelmintic in the same way as in uncinariasis. It is obvious that in the second stage some other method must be employed. The authors devised the following plan: Fifty grains of thymol were dissolved in 50 c.c. of sterile olive oil which had been autoclaved for several minutes. The solution was then sterilized and used. The patient was given from 2 to 3 c.c. of this solution subcutaneously or intramuscularly daily for seven days. It was then discontinued for several days and again repeated.

The patient had a septic temperature ranging from 99° to 103° F. He was listless and complained much of pain and swelling under the eyes. On treatment with thymol the temperature quickly subsided; the pain in the muscles and the swelling of the conjunctiva disappeared, and the patient became normal mentally. He was discharged from the hospital cured. The patient felt no discomfort. A rash appeared on the palmar surfaces of the hand, which cleared up when the drug was stopped.

Vaccines. In spite of the fact that the use of vaccines require a just appreciation of their limitations and dangers, this method of treatment is being constantly used by those with little or no knowledge of the subject. D. J. Davis¹ emphasizes the fact that an enormous number of patients are now being treated throughout the country by this method. Much of it will be done by inexperienced men, and no doubt we may expect some serious accidents to occur. He urges that it is necessary to take a conservative stand in the administration of these preparations and to advise strongly against the use of all sorts of unstandardized bacterial products which are now offered to the profession. Furthermore, it is essential to keep in mind that the important domain of vaccines is protective and not curative, according to present data.

In diseases of the ear, nose, and throat, Coates² feels that although vaccines have not fulfilled all of their early promise they offer an additional method of combating infections in these regions. In the treatment of *ozena* he is of the opinion that vaccine therapy might solve a problem which has been puzzling clinicians for years.

Wayson³ states that the diseases which are perhaps most detrimental to the efficiency of military bodies are those of the intestinal tract. To the ubiquitous dysentery and typhoid fever are added in Europe the paratyphoid fever and cholera. The problems involved in the attempt to immunize soldiers against these diseases have been summarized by Theobald Smith as follows: The object of immunization is to raise the resistance of the body. No kind of vaccination is invariably and completely protective. We may, however, hope to convert a fatal into a non-fatal attack, a mild attack into one so mild as to remain unrecognized, or into complete protection. The essential factor to be kept in mind is to raise such resistance with the least injury to the subject.

¹ Journal of the American Medical Association, January 20, 1917.

² *Ibid.*

³ *Ibid.*, July 28, 1917.

There is a clearly marked distinction between groups of organisms as to the capacity of the hosts to be immunized experimentally. The object of immunization is to suppress the invader; the problem underlying is to find the precise aggressive weapons which prevent the invader from multiplying.

TYPHOID AND PARATYPHOID VACCINATION. Wayson points out that the separation of typhoid fever into three distinct infections was effected, but the prevalence of paratyphoid infections and the interrelations of typhoid and paratyphoid have become of great importance during the present war. Widal and Salimbeni¹ state that in the beginning anti-typhoid inoculation alone was practised in France, but it soon became evident that a combined vaccine was needed to add protection against paratyphoid.

As regards the dosage of these mixed vaccines, Wayson² states that the practice varies. By mixed vaccine he has reference to one composed of typhoid and paratyphoid A and B; by triple simultaneous vaccine three injections are given: one of typhoid, one of paratyphoid A, and one of paratyphoid B. If the vaccine is mixed (equal parts of typhoid, paratyphoid A, and paratyphoid B) the first dose consists of 500,000 millions and the second of 1000 millions. Widal and Salimbeni state that the French mixed vaccine contains 10 billion organisms to each 3 c.c. Two injections are given, 1 c.c. and 2 c.c. successively, with an interval of a week. If only one injection can be given they recommend the use of 1.5 c.c. of the vaccine.

In addition to a triple mixed vaccine a *tetravaccine* has been used. This consists of typhoid and paratyphoid A and paratyphoid B and *cholera*. Mendelson³ has given his experience with this combination. He and his colleagues inoculated in Serbia more than 120,000 soldiers and prisoners, and also some of the civil population. From this experience he draws the following conclusions: (1) That it has been positively demonstrated that animals inoculated with more than one species of bacteria, within limits, developed agglutinins and immune bodies for all the species injected, the amount of such being not distinctly inferior to that observed in control animals inoculated with one species only. (2) The inoculation of a combined vaccine is harmless. They had no septic or other accidents in any of the more than 50,000 men inoculated, thus entailing more than 100,000 injections. They have never discovered any really serious reactions, either local or general, the inoculated persons being, as a rule, able to attend to their duties in from twenty-four to forty-eight hours after injection. (3) The inoculated persons developed protective substances for the four organisms—typhoid, paratyphoid A, paratyphoid B, and *cholera*. The amount of agglutinins present for each of the four organisms is practically the same as in control individuals inoculated with a single organism. (4) The tetravaccine should be used as a matter of routine to inoculate the troops, greatly exposed as they are to these four diseases. Its use renders it

¹ La Presse Médicale, 1917, xxv, 1.

³ Military Surgeon, October, 1916.

² Loc cit., discussion.

possible to give simultaneous protection for the four maladies by a simple and rapid procedure.

In writing of the *curative use of stock typhoid vaccine*, Whittington¹ concludes that it cannot be recommended for the following reasons: The vaccine neither shortens nor reduces the number of complications in even that class of case which is likely to do well; there is a decided suspicion that the vaccine increases the incidence of hemorrhage; finally, it is in the very type of case in which aid is so much needed that the vaccine is most disappointing.

Although the reaction following the use of typhoid vaccine subcutaneously may make the patient uncomfortable for some hours, it is rarely serious. An instance of an unusually *severe reaction* has been reported by Lintz.² Twenty minutes after the first dose the patient was seized with sudden weakness, violent shaking all over the body and a throbbing headache. The continued vomiting set in. There was soreness all over the body and the joints very painful. The temperature rose to 103° F. and the pulse-rate to 100 (normal 60). These symptoms continued for forty-eight hours during which time the patient was apathetic. The urine was red and contained blood. The temperature continued high for three days. On the second day the spleen became palpable and the superficial lymphatic nodes enlarged. Lintz cites this case in order to emphasize the necessity of instructing patients to go home and not to their vocations—otherwise one runs the risk of submitting the patient to considerable danger.

In view of the *frequency of institutional epidemics of typhoid fever*, Newcomb³ believes that the preferable way is to prevent their occurrence by means of general immunization whenever typhoid fever exists in the vicinity or on the advent of the first suspicious resident case. An even better plan is the routine inoculation of all new patients and employees.

WHOOPIING-COUGH. Reports on the efficacy of *pertussis vaccine* are not in agreement. Luttinger,⁴ who had charge of the whooping-cough clinic of the Department of Health, New York City, obtained results favorable to the use of the vaccine. It is his belief that the results obtained at the clinic, and by over 180 private physicians and health officers, would warrant the routine use of the vaccine for both curative and prophylactic purposes. The best time to institute the vaccine treatment as a curative agent is the first and second week of the paroxysmal stage.

Bloom⁵ thinks the treatment effective, providing the procedure is correct. He advises a large initial dose, not less than 120,000,000; increase 60,000,000 for each succeeding dose, and give maximum quantity every other day until one of the marked symptoms show an appreciable improvement. Continue the injections every three or four days until cured. As Hare has pointed out, one of the practical difficulties

¹ Journal Royal Medical Corps, October, 1916.

² Journal of the American Medical Association, May 5, 1917.

³ Ibid., December 9, 1916.

⁴ Ibid., May 19, 1917.

⁵ New Orleans Medical and Surgical Journal, September, 1916.

in private practice is the objection of both mother and child to repeated needlings.

Caronia¹ reports 155 children treated with vaccine. Of this number he states that 61.28 per cent. were cured; 32.25 per cent. improved; and only 6.45 per cent. were uninfluenced by the treatment. Some of the cases required only three to five injections; others received as high as ten. The disease had been from five to forty-five days in all but three, and a large number of the children were less than one year old.

Abt² is of those who consider that the vaccine treatment of whooping-cough is still under consideration.

Von Sholly, Blum and Smith³ in their investigation of the result of vaccine treatment are not much impressed. They believe that more observations and more critical observations with controls for comparison must be made before the value of the vaccine can be determined. They state that at present the statistics are largely based on the reports of the parents and that one must not be too ready to accept favorable "impressions."

VULVOVAGINITIS. Condat⁴ has now used *antigonococcus vaccine* in forty little girls suffering from this complaint. She says that the vaccine has been constantly effective. Her experience is not in accord with others, who, for the most part, have found this method only occasionally beneficial. The treatment of vulvovaginitis in children is difficult and usually a prolonged affair. The best results have been obtained by means of cleanliness. The children should receive a daily douche of some mild antiseptic solution, such as creolin. In some cities special clinics are available. Many cases are also treated by the Visiting Nurse.

PYORRHEA ALVEOLARIS. Medalia⁵ considers the various means for combating this condition. He does not go into details as to the dental measures needed, as he always depends on the dentist for this phase of the treatment. As to *emetine*, he believes that any benefit derived from this drug can be ascribed to its hemostatic and bactericidal properties and not to its effect on the endameba which may be present. Personally, he has had no occasion to employ the drug, as *autogenous vaccines* have given him the desired results. He has had a number of patients referred to him for vaccine treatment in whom emetine had been used without results—the loose teeth were still loose and the pockets contained pus, bacteria and in some instances endamebæ.

SEPTIC WOUNDS. In the treatment of septic wounds, Swan⁶ states that the greatest value of vaccine therapy is in the treatment of complicated septic fractures of the long bones and fractures which open into joint cavities. He employs a polyvalent proteus and mixed *streptococcus vaccine*. After two or three days he freely opens the wound to secure adequate drainage, approximates the fragments and removes

¹ *Pediatrics*, June, 1917.

² *Archives of Pediatrics*, December, 1916.

³ *Journal of the American Medical Association*, May 19, 1917.

⁴ *Archives de médecine des Enfants*, May, 1917.

⁵ *Boston Medical and Surgical Journal*, September 14, 1916.

⁶ *Lancet*, October 7, 1916.

those fragments which are undoubtedly separated. He also takes advantage of the opening of the wound to further bacteriological studies. Swan states that one of the features of cases treated by this polyvalent vaccine is the freedom from secondary hemorrhage.

Veratrone. Haultain,¹ who has previously written on the use of this drug in the treatment of *eclampsia*, has contributed another paper on the subject. He reports 38 consecutive cases of *eclampsia* treated with veratrone. He considers it of the utmost value in the treatment of this condition. After the initial dose, subsequent doses should be regulated by the blood-pressure.

X-rays. MALIGNANT DISEASE. In the section on *Radium* mention was made of the fact that in malignant growths there is usually an out-wandering of cancer cells into the tissues adjoining the tumor. In order to kill these cells, both radium and the x-rays are recommended. Both these agents are used as a postoperative measure in order to prevent or minimize recurrences. Based on his long personal experience, Bédère² states he has never found radiotherapy to be dangerous except when the dose is excessive. Given in a dose well calculated it never does harm. Even with excessive dosage he is of the belief that there is no danger except for the skin, although it might be unwise to push exposures to the spleen and thyroid gland beyond the point where the desired result has been attained. On the other hand, exposures of uterine fibromas or the ovaries do not entail any danger for the normal tissue of the uterus or the organs in the immediate vicinity, especially the bladder and intestines. He states that over ten years' experience has failed to reveal anything suggesting that a cancer can be aggravated by the exposures or its generalization hastened. In regard to the repeated acute radiodermatitis on the hands of röntgenologists and which may develop into an epithelioma, Bédère believes this to be due to repeated irritation of the skin just as repeated irritation of the lips or tongue may cause cancer in smokers. Finally he expresses the opinion that all irritations of the skin and mucous membranes which cause interference with their nutrition, especially persisting ulceration, open the portals to the mysterious agent of cancer. Insofar as the x-rays are concerned, however, there is nothing known that would justify the fear that radiotherapy applied to sound skin might generate a cancer in subadjacent tissues.

In an analysis of 100 consecutive cases of *carcinoma of the breast*, Oliver³ recommends postoperative röntgen-ray treatment. Occasionally treatment by the x-rays brings about marked retrogression of the growth independently of operative interference. Chilaïditi⁴ reports an inoperable case of carcinoma of the breast in which complete retrogression occurred under intensive cross-fire exposure of the röntgen rays. In this case the cancer developed rapidly in the sixth month of pregnancy. The growth infiltrated the breast and was quite hard.

¹ Edinburgh Medical Journal, December, 1916.

² Paris Médical, June 2, 1917.

³ Annals of Surgery, January, 1917.

⁴ Greece Médicale, xviii, No. 5-6, 1916; Journal of the American Medical Association, October 14, 1916.

The lymph nodes in the axilla and in the supraclavicular and subclavicular regions were enlarged. In addition, there was a strong suspicion that the mediastinal lymph nodes were enlarged. In giving advice as to the use of the *x*-rays in malignant disease, practically the same rules hold true as for radium (see section on Radium).

In a series of 35 cases of *lymphosarcoma*, Holding¹ had the unusual opportunity of comparing various methods of treatment—operative, autogenous vaccine, mixed toxin (Coley's fluid), radium, *x*-rays. Five patients were treated by means of the *x*-rays alone; of these, 1 has been symptomatically well for three years; in 2 the masses disappeared, but later appeared in other parts of the body, and both patients are now dead; the other 2 are unimproved. Twenty-three patients were treated with massive doses of the *x*-rays in addition to other methods; of these, 15 were improved. Two patients were treated with *radium* alone; 1 has been free from symptoms for a year; the other improved for a time but later died. Seven were treated with radium in conjunction with other methods. One of these has been free from symptoms for one year; 6 were improved.

UTERINE FIBROMA AND UTERINE HEMORRHAGE. The value of the *x*-rays in the treatment of uterine hemorrhage is now quite generally acknowledged. Beutner² reports 32 cases of uterine fibromas and 12 of uterine hemorrhage treated by means of the röntgen rays. Although he believes that operative measures are preferable, especially when it is necessary to relieve the patient as soon as possible and with the least expense, the *x*-rays are a most valuable resource when, for any reason, operative interference is impracticable. In a communication from the Freiburg Gynecologic Clinic, Friedrich and Krönig³ state that they have adopted a single exposure of the *x*-rays in the treatment of hemorrhagic uterine affections. This they believe to be preferable to any other method. The gauge of the treatment are the iontoquantimeter findings.

Seits and Wintz⁴ also advocate a single exposure in cases with hemorrhage due to fibromyomas or to the climacteric. They employ a single intensive through a 0.5 mm. zinc filter. This allows of twice the dose practicable with an aluminum filter. Several fields are exposed, each field taking about an hour. In very sensitive patients the dose is divided, giving a fraction of the total dose at two or three sittings.

Klein,⁵ in the treatment of uterine neoplasms, combines the *x*-rays with radium and radio-active substances, and a preparation of radium-barium selenate injected intravenously. The exposures are made about once a month until there is no more clinical evidence of cancer. Of 92 patients with inoperable *malignant disease of the uterine cervix*, 18.5 per cent. have had no further sign of trouble. The interval ranged from four months to three years.

¹ *Annals of Surgery*, June, 1917.

² *Revue médicale de la Suisse romande*, September, 1916.

³ *Münchener med. Wchnschr.*, October 10, 1916.

⁴ *Ibid.*, December 19, 1916.

⁵ *Ibid.*, December 26, 1916.

EXOPTHALMIC GOITRE. In many cases of exophthalmic goitre the *x*-rays give excellent results. The employment of the *x*-rays in this disease was suggested by the fact that the rays are known to have a selective action upon glandular tissue. Aiken¹ in discussing the various methods of treatment states that excellent results have been reported by Kienbock, Nagelschmidt, Dawson and others. Some believe that patients suffering from this condition should always be submitted to a preliminary treatment with the *x*-rays before operative interference. It is believed that this plan will materially reduce the operative mortality. Means and Aub² conclude, from their experience that in certain cases, particularly the less severe ones, the *x*-rays alone may cause a definite decrease in the metabolism, in fact, that it may be brought to normal; that in certain cases treatment by means of rest plus the *x*-rays there was more improvement than could be accounted for by rest alone; and, finally, that in other cases, usually severe in type, there is not the slightest improvement, even though complete rest is combined with prolonged irradiation. Fischer³ gives an excellent historical review of the application of the röntgen rays in the treatment of exophthalmic goitre. In his opinion the treatment is logical, as we know that the action of the rays causes a destructive action on the gland and thus reduces excessive thyroid secretion.

Aside from operative interferences, Fischer believes that röntgenotherapy is far more effectual than all other measures combined. In a comparison of results obtained by thyroidectomy and röntgenotherapy, he found that 82 per cent. of cases were materially improved or permanently cured by thyroidectomy, and that 80 per cent. were cured or improved by the *x*-rays. An advantage in favor of the *x*-rays is that this method of treatment is comparatively harmless, while thyroidectomy shows a mortality of between 5 and 6 per cent.

Fischer has treated 94 cases of exophthalmic goitre and 37 of simple goitre with the *x*-rays. Positive benefit was obtained in from 77 to 80 per cent. of all the cases, while no improvement took place in the remainder. A complete subsidence of all objective and subjective symptoms of exophthalmic goitre was realized in 15 cases. Some of the others showed various degrees of improvement and some showed no improvement. The thyroid subsided to normal in 22, and in fully two-thirds of the remainder became much reduced in size. The exophthalmos was the most refractory symptom.

My personal experience has been small, but it agrees with that of Fischer. In a very severe case recently under observation, marked relief from the tremor, tachycardia and especially the nervousness, followed these courses of treatment but they always recurred. This case has been advised to have a thyroidectomy done.

THYMUS GLAND. Another of the glandular structures which responds quickly to the influence of the *x*-rays is the thymus. Friedländer⁴

¹ New York Medical Journal, July 8, 1916.

² Journal of the American Medical Association, July 7, 1917.

³ Ugeskrift for Læger, October 5, 1916; Journal of the American Medical Association, December 2, 1916.

⁴ American Journal Diseases of Children, July, 1917.

emphasizes three facts with reference to enlargement of the thymus: (1) the condition is much commoner than is ordinarily supposed; (2) the diagnosis can be made definitely by means of simple physical examination and the röntgen rays; (3) in the *x*-rays one possesses a therapeutic agent, which, in itself, will effect a cure in the vast majority of cases.

SKIN DISEASES. Knowles and Ludy¹ emphasize the prevalence and the chronicity of *ringworm of the scalp*. As a result of their experience in the treatment of 83 cases, they express the opinion that the use of the *x*-rays is a step forward in the cure of this very chronic and troublesome affection.

Le Fevre² states that for some years past he has had excellent results with the röntgen rays in the treatment of *acne*. He feels that the results justify the case, the time and the expense required for this method of treatment.

Yeast. In the treatment of *infantile scurvy*, Hess³ has demonstrated that yeast is of no value either as a prophylactic or as a curative dietetic agent. He did find, however, that it possessed some value as a stimulant to growth, when added to the milk in the form of the fluid autolyzed yeast or given to older infants as a desiccated powder.

Zinc. The belief that *pyorrhea alveolaris* is caused exclusively by amebas has been abandoned, and it is now recognized that while these organisms are often present, they play a comparatively minor role in the causation of this trouble. Harris⁴ states that among the conditions which have been advanced as being causative agents may be mentioned syphilis, rheumatism, liver affections, and auto-intoxication. These conditions lower the general resistance and allow the bacteria, which are constantly in the mouth, to become active. Treatment directed toward the correction of a systemic disease is therefore a necessary part of the treatment.

In the treatment of *interstitial gingivitis*, Talbot⁵ states that the first symptom is bleeding of the gums after the slightest injury. Local treatment should be started immediately with several local applications of tincture of iodine. If the gums are congested, scarification may be practised, and, in addition, festoons of loose tissue which hang down between the crowns of the teeth should be removed. Loose teeth should be pulled. For disinfecting, astringent purposes, the following preparation is recommended:

Water	10 parts
Zinc chloride	15 "
Iodine	25 "
Glycerin	10 "

This preparation is applied to the gums, teeth, and mucous membrane by a long, slender applicator with cotton wound around the end. It should be applied every other day and is not to be used by the patient.

¹ Pennsylvania State Medical Journal, February, 1917.
² Ohio State Medical Journal, February, 1917.
³ American Journal of Diseases of Children, January, 1917.
⁴ Journal of the American Medical Association, February 10, 1917. ⁵ Ibid.

The following preparation should be used by the patient three times a day.

Zinc sulphocarbolate	60 grains
Alcohol	1 ounce
Distilled water	2 ounces
True oil of wintergreen	8 drops

The patient's general health should be considered. This is quite as important as the local treatment.

The use of chloride of zinc in *uterine hemorrhage* is recommended by Boldt.¹ He uses it in all instances of severe bleeding, whether due to metro-endometritis or simple endometritis, but particularly when caused by interstitial myomas of small size. Boldt states that he employs a 50 per cent. solution of the zinc more frequently than weaker solutions. Care must be taken to avoid having the drug come in contact with the cervical mucosa lest a stricture result. The injection is made with a special syringe. One application once in four weeks usually suffices to control the bleeding. From four to twelve applications are usually needed. Boldt emphasizes the fact that one should always be sure that the bleeding is not caused by malignant change of the endometrium.

¹ Journal of the American Medical Association, March 17, 1917.

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